

I.—SUB-ATOMICS.

Fine structure of hydrogen. A. Sommerfeld (*Z. Physik*, 1941, 118, 295—311).—The observed displacement of the 2S terms towards higher energies than those given by Schrödinger's equations is accounted for by development of Dirac eigenfunctions for continuous variation of potential with nuclear separation. L. J. J.

Forbidden transitions in the Zeeman effect with the alkali metals. F. Gabler and J. Tomiser (*Naturwiss.*, 1942, 30, 281).—Forbidden components in the Zeeman spectra of Na, K, Rb, and Cs, together with their degrees of polarisation, are given. A. J. M.

Position of the $3p^1D$ term in O III. B. Edlén (*Naturwiss.*, 1942, 30, 279).—The position of the $3p^1D$ term of O III was formerly deduced from two lines, of which, however, the identification appears to have been mistaken. When the correct combinations are used, the deviation of this term from that expected from the C I and N II spectra disappears. The val. of R obtained agrees with that for C I and N II. A. J. M.

Simplified formulation of the limiting laws of quantum states of atoms and its application to the determination of atom terms. P. Gombás (*Z. Physik*, 1941, 118, 164—180).—A statistical formulation of the permitted states of valency electrons is developed, and applied to give an approximation formula for the determination of terms and eigenfunctions of the valency electrons of atoms and ions. A. J. M.

Calculation of multiple terms of the Na and K atoms, and the ground terms of the Al^+ and Al^{++} ions. B. Kozma and A. Kónya (*Z. Physik*, 1941, 118, 153—163).—The approximation method of Gombás (cf. preceding abstract) has been used to calculate the 3S, 4S, 3P, 4P, and 3D terms of the Na atom, the 4S, 4P, 3D, 4F, and 5G terms of the K atom, and the ground terms of Al^+ and Al^{++} with the corresponding eigenfunctions. The results agree well with the empirical vals. A. J. M.

Characteristic pressure-widening of mercury lines. R. Rompe and P. Schulz (*Z. Physik*, 1941, 118, 269—276).—The widths of the resonance terms 2^1P_1 in the 10140 Å. line in the high-pressure discharge in Hg are compared with the theoretical vals. The characteristic pressure-widening of lines depends on the no. of similar atoms and the f -no. of the transition of the widened term to the ground state. Determinations were made at pressures of 4.5—80 atm. The temp. of the arc was also found. A. J. M.

Th III spectrum. T. L. de Bruin, P. F. A. Klinkenberg, and P. Schuurmans (*Z. Physik*, 1941, 118, 58—87).—Zeeman effects in Th III are investigated. About 200 lines between 2000 and 9000 Å. are arranged in two term systems. Theoretically predicted term groups are identified. Calc. g vals. are compared with Landé vals., and the g -“sum law” is generally followed within the limits of experimental error. The data are compared with those on Ce III and La II spectra. W. R. A.

Low-tension sparks and spectrographic detection of difficultly excitable non-metals.—See B., 1942, I, 484.

Quantitative spectroscopy.—See A., 1942, I, 409.

Quantitative spectrographic analysis by the arc method.—See A., 1942, I, 411.

Photometric study of the profiles of the Fraunhofer lines in the solar spectrum. I. Mg b group. Y. P. Rao and C. K. Ananthasubrahmanyam (*Indian J. Physics*, 1942, 16, 177—186).—Data obtained by photographic photometry and by the direct-reading photo-electric spectrophotometer are given and discussed. N. M. B.

Comparison of emission lines of Novae Herculis 1935 and Lacertae 1936. P. Rossier (*Arch. Sci. phys. nat.*, 1942, [v], 24, Suppl., 38—40).—The relative line intensities for the two novae are of the same order. L. J. J.

Ionisation in stellar atmospheres composed of n kinds of atoms. Y. Fujita (*Japan. J. Astron.*, 1936, 13, 141—160).—Theoretical. CH. ABS. (e)

Theory of the initial avalanche in the breakdown of a discharge counter in helium. S. C. Brown (*Physical Rev.*, 1942, [ii], 62, 244—254).—On the basis of Townsend's criterion, a general treatment

of breakdown between coaxial cylinders to the limiting case of parallel plates is developed. The functional form of the photon effect leads to the assumption that two types of photons are operative, which can be identified with the resonance radiation of He I and He II. Theoretically derived graphical methods for predicting breakdown voltages are given. N. M. B.

Relation between isothermal and adiabatic Ettingshausen-Nernst coefficients. M. Kohler (*Z. Physik*, 1941, 118, 312—316).—The discrepancy found by Frank (*ibid.*, 1931, 63, 596) between isothermal and adiabatic Ettingshausen-Nernst consts. vanishes when the metal plate and its connecting leads are thermoelectrically equiv., and when the thermo-effects between magnetised and unmagnetised metal are sufficiently small. L. J. J.

Spectral sensitivity distribution of selenium barrier-layer cells. F. Eckart and A. Schmidt (*Z. Physik*, 1941, 118, 199—209).—The effect of metallic impurities (Cd) on the photo-electric properties of Se barrier-layer cells has been investigated. The addition of small quantities of Cd causes a smoothing out of the long- λ falling-off of sensitivity of the cell, but the addition of larger quantities causes the appearance of a second max. at 0.7 μ . The phenomena can be explained by the existence of small areas of CdSe, crystallising in the Zn blende type, included in the Se layer. Hexagonal CdSe, crystallising in the wurtzite type, is also photo-sensitive. A. J. M.

Long-wave selective photo-effect in super-semi-conductors. G. Maurer (*Z. Physik*, 1941, 118, 104—121).—A new theory of long-wave selective photo-effect in super-semi-conductors is advanced and an emission formula derived. An “inner” and an “outer” photo-effect combine. W. R. A.

Precision determination of h/e by means of the short-wave-length limit of the continuous X-ray spectrum at 20 kv. W. K. H. Panofsky, A. E. S. Green, and J. W. M. Du Mond (*Physical Rev.*, 1942, [ii], 62, 214—228).—To obtain further evidence on the discrepancy between vals. from direct and indirect methods, practical improvements giving increased accuracy are described, and sources of error in measurements and interpretation are discussed. The new val. $h/e = (1.3786 \pm 0.0002) \times 10^{-17}$ erg sec./e.s.u. is in fair, but not complete, agreement with measurements of other at. consts. N. M. B.

Ionisation of argon and neon by electron impact. D. P. Stevenson and J. A. Hipple (*Physical Rev.*, 1942, [ii], 62, 237—240).—The ionisation efficiency curves for Ar^+ , Ar^{++} , Ne^+ , and Ne^{++} , and tabulated data for the relative probabilities of forming the singly and doubly charged ions, are given and discussed. N. M. B.

Cathodic sputtering in the glow discharge. I. Primary vaporisation of copper. A. Günther-Schulze (*Z. Physik*, 1941, 118, 145—152).—Cathodic sputtering is considered as both an evaporation and a diffusion process. It is necessary to determine the no. of atoms vaporised per coulomb (N_p), and its dependence on cathode drop, cathode material, surface characteristics of the cathode, and the type of gas used, and the no. of atoms diffusing per coulomb (N_d). A method of determining N_p is described for Cu in He, Ne, Ar, and H₂, and for a cathode drop of 480 v. A. J. M.

Physical characteristics of supervoltage Röntgen rays.—See A., 1942, III, 933.

Comparison of certain aspects of 200- and 400-kv. radiation.—See A., 1942, III, 933.

Secondary electron emission of semi-conductors or insulators. G. Maurer (*Z. Physik*, 1941, 118, 122—144). W. R. A.

Structure of the nucleus. N. Tsunajima (*Sanshusha Press, Tokyo, Separate*, 1936, 20 pp.).—Theoretical. The average separation of an electron and positron in the lowest quantum state is $\sim 3 \times 10^{-13}$ cm. The radius of the neutron is $\sim 0.2 \times 10^{-13}$ cm. CH. ABS. (e)

Statistics of isotope distribution in condensed particles. L. Holleck (*Z. Physik*, 1941, 118, 340—342; cf. *ibid.*, 1940, 116, 624).—A probability function is derived for the occurrence of isotopic compositions lying between specified limits. L. J. J.

Magnetic field measurement in β -ray spectroscopy.—See A., 1942, I, 411.

Permanent magnet β -ray spectrograph.—See A., 1942, I, 411.

Fission of the deuteron by fast neutrons. E. Bagge (*Physikal. Z.*, 1942, 43, 226—236).—Recoil particles produced in H_2 and D_2 by neutrons from $Ra + Be$ are studied in a cloud-chamber. The energy distribution of the primary neutrons at 0.8—3 Me.v. is deduced. With D_2 the range distribution curve for the recoil particles has a peak at ~ 2.6 cm. air-equiv., attributed to a fission of deuterons; the sharpness of the peak is ascribed to a resonance effect. The effective cross-section for fission by neutrons in the $Ra + Be$ spectrum at ~ 3.5 Me.v. is $\sim 3 \times 10^{-25}$ sq. cm. The expected angular and energy distribution of the recoil particles is compared with the observed distribution. A. J. E. W.

Effective cross-sections for reactions between neutrons and deuterons. K. H. Höcker (*Physikal. Z.*, 1942, 43, 236—257).—A derivation of the eigenfunction for the system ${}^2_1H + {}^1_0n$ and a solution of the Schrödinger equation applicable to this system are given. Allowance is made for exchange effects, but polarisation of the deuteron is necessarily neglected. Calc. cross-sections are: for scattering, 2.5×10^{-24} sq. cm. for thermal energies, and 1.6×10^{-24} for energies of ~ 2.8 Me.v.; for neutron capture, 1.7×10^{-28} sq. cm.; for fission of the deuteron, 2×10^{-24} sq. cm. (10-Me.v. neutrons). Fission can occur only with neutrons of energy ≤ 3.45 Me.v. A. J. E. W.

Physical differences between types of penetrating radiation. A. H. Compton (*Amer. J. Roentgenol.*, 1940, 44, 270—275).—Neutron rays have about the same penetrating power as high-voltage X-rays but the ions they produce occur in highly conc. groups; they also act much more strongly on H-containing substances than on any other whilst for hard X-rays H is least effected. H. L.

γ -Radiation of light elements by proton irradiation. N. Hole, J. Holtsmark, and R. Tangen (*Z. Physik*, 1941, 118, 48—57).—Excitation functions for γ -radiation produced when Li, B, C, Na, Mg, Si, and Cl are bombarded with protons have been measured and compared with existing data. The widths at half max. intensity have been determined from resonance data. W. R. A.

Nuclear excitations resulting from radioactive decay. E. H. Plesset (*Physical Rev.*, 1942, [ii], 62, 181—186).—Radiations emitted by several radioactive nuclei were investigated with a permanent β -ray magnet spectrograph. Four transitions result from the decay of ${}^{57}Co$. No internally converted radiation is emitted by ${}^{65}Zn$ in the region 20—300 ke.v. A complicated and only partly resolved spectrum is emitted by the products of deuteron bombardment of Au. N. M. B.

Short range α -particles from fluorine bombarded with protons. R. A. Becker, W. A. Fowler, and C. C. Lauritsen (*Physical Rev.*, 1942, [ii], 62, 186—196; cf. Streib, A., 1941, I, 187).—Data and measurements for the ranges of the α -particles from the five resonances in the bombardment of F with protons are tabulated. The Q vals. of the particles obtained at 334, 867, 927, and 1363 ke.v. are identical, viz., 1.81 ± 0.04 Me.v. The Q val. of the low-energy α -particle obtained at the 1220-ke.v. resonance is 1.93 ± 0.07 Me.v. Hence the energy separation for the two corresponding states of ${}^{16}O$ is 0.12 ± 0.08 Me.v. At least one of the two resonances near 900 ke.v. must yield short-range α -particles with non-spherically symmetric angular distribution. N. M. B.

β -Ray spectra of arsenic, rubidium, and krypton. G. L. Weil (*Physical Rev.*, 1942, [ii], 62, 229—237).—Cloud-chamber measurements on the β -rays emitted by the radioactive nuclei ${}^{76}As$ (27 hr.), ${}^{88,290}Kr$ (3 hr.), and the decay product ${}^{88,90}Rb$ (18 min.) of the latter give results: half-life 26.8 hr., —, 17.5 min., respectively; and upper energy limits of the disintegration electrons, 2.71, 2.5, 5.1 Me.v., respectively. Fermi and Konopinski-Uhlenbeck plots and analyses are reported and discussed. N. M. B.

Electron components of cosmic radiation and the instability of mesotrons. G. Cocconi and V. Tongiorgi (*Z. Physik*, 1941, 118, 88—103).—Two series of measurements, at altitudes 120 and 2200 m. above sea level, have been carried out to determine the change and relation between electron and mesotron components of cosmic radiation with respect to zenith angle. Decomp. components and residual primary components in the lowest layers of air have approx. equal intensities, thus postulating modification of accepted views on the decomp. of mesotrons. The life of a mesotron is $\sim 3\text{--}4 \times 10^{-6}$ sec. W. R. A.

Compton effect for mesons. R. Iskraut (*Z. Physik*, 1941, 118, 181—198).—Theoretical. The Compton effect is calc. for mesons when the incident radiation is not of too short λ , and the treatment is non-relativistic. The method is based on that of Gordon and Sommerfeld (A., 1927, 84). The spin of the meson exerts no effect on the scattered radiation to the degree of approximation of the calculation. A. J. M.

Determination of soft cosmic-ray components through various materials for the estimation of the proportion of disintegration electrons. B. Siegert (*Z. Physik*, 1941, 118, 217—231).—The no. of disintegration electrons and their secondaries produced per meson is determined experimentally by finding the difference between the

soft components in air and after passing through a light solid or liquid. Pb absorption curves are obtained by the use of three counters for the vertical intensity in air, and after passage of the rays through H_2O , C, and Fe. The ratio of soft to hard radiation in air is 0.32; after passage through H_2O and C it is 0.20, and after passage through Fe 0.16. The mean disintegration time of the meson is 3.5×10^{-6} sec. A. J. M.

Proton-proton interaction and the Yukawa particle. K. C. Kar (*Indian J. Physics*, 1942, 16, 187—195).—Proton-proton scattering, previously examined with a short-range interaction potential of the type Ae^{-ar} (cf. A., 1942, I, 32), is treated with a Yukawa-type potential $V(r) = (A/r)e^{-ar}$. The rigorous formula deduced agrees well with experiment (cf. Heydenburg, A., 1940, I, 51). The fitting vals. of A and a give vals. of the short-range charge and mass of the neutretto agreeing exactly with those for the mesotron as determined from the binding energy of the deuteron. N. M. B.

Electric quadrupole moments of light and heavy nuclei. S. B. Welles (*Physical Rev.*, 1942, [ii], 62, 197—203).—Mathematical. On the assumption that the asymmetrical nuclear charge distribution is due to a single proton, a general expression for the electric quadrupole moment as a function of nuclear spin is obtained. It is deduced that the quadrupole moment is negative and its val. increases negatively as nuclear spin increases. The calculation for light nuclei shows that the addition of a proton to a nucleus with Q originally zero produces a negative quadrupole moment. N. M. B.

Cloud-chamber study of collision electrons in equilibrium with mesons. L. Seren (*Physical Rev.*, 1942, [ii], 62, 204—214).—Pb blocks of different thicknesses above a cloud chamber containing a W plate allowed a distinction between mesons and electron showers. Of 601 meson tracks observed, with no magnetic field, 497 traversed the W plate; hence the % of fast collision electrons in equilibrium with mesons in W and Pb is 10.5 and 8, respectively, in agreement with theory. 143 collision electrons with energy range 13—175 ke.v. were produced by meson tracks in the gas and indicate a $1/E^2$ differential spectrum. N. M. B.

Pair-theory of nuclear forces. G. Wentzel (*Z. Physik*, 1941, 118, 277—294). The dependence of static nuclear forces on separation is calc. approx. on the basis of a scalar pair-theory without recourse to perturbation methods. The field is quantised according to Bose-Einstein statistics after substitution of zero particle-spin vals. for $\frac{1}{2}$ vals. The method gives a relation in agreement with that given by perturbation theory, but abs. vals. given for nuclear forces are too high. L. J. J.

Influence of an "uneven" anisotropy on the path of light rays. P. Frank (*Physical Rev.*, 1942, [ii], 62, 241—243).—Mathematical. N. M. B.

Rotating disc. C. W. Berenda (*Physical Rev.*, 1942, [ii], 62, 280—290).—Relativistic geometrical considerations lead to a suggested new test of general relativity by the cyclotron; an artificially radioactive element of low at. wt., revolved as ions in the cyclotron, should be more radioactive, on being brought to rest, than an equiv. sample remaining at rest. N. M. B.

II.—MOLECULAR STRUCTURE.

Completion of the analysis of CH bands. L. Gerö (*Z. Physik*, 1941, 118, 27—36).—By the investigation of predissociation phenomena in CH bands excited in different ways the analysis of known bands has been extended to higher rotational quantum nos. and the rotational analysis of the (2, 2) band of the $A^2\Delta \rightarrow X^2\Pi$ system 4300 Å. has been made. W. R. A.

Predissociation phenomena in the CH and CD bands. L. Gerö and R. Schmid (*Z. Physik*, 1941, 118, 210—216).—CH and CD bands excited under various conditions and with different pressures in the source of light exhibit a no. of predissociation phenomena. Limit curves are given, and the positions of the atom term combinations are indicated. The CD mol. is more stable than CH. A. J. M.

Dissociation of isotopic molecules. L. Gerö and R. Schmid (*Z. Physik*, 1941, 118, 250—256).—Isotopic mols. do not have the same potential curves. For deuterides the curves are usually somewhat higher than those of hydrides, showing greater stability, in agreement with other results. A. J. M.

Structure of the electronic bands of the OD molecule. V. A. Doubling. M. G. Sastry (*Indian J. Physics*, 1942, 16, 169—175; cf. A., 1942, I, 223).—The A-doubling in the ${}^3\Pi$ states is examined on Mulliken's theory. The doublet difference $\delta\nu_{2dc}(K) - \delta\nu_{1dc}(K)$ varies nearly linearly with K . The doubling in OD is $<$ in OH (cf. Johnston, A., 1934, 237); the ratio is ~ 0.31 . N. M. B.

${}^2\Pi_u$ — ${}^2\Pi_g$ bands of CO_2^+ . II. S. Mrozowski (*Physical Rev.*, 1942, [ii], 62, 270—279; cf. A., 1942, I, 131).—Full data and rotational analyses for 24 new sub-bands are reported and const. are evaluated. Former vals. of const. are corr. and A-doubling for all levels is calc. N. M. B.

Influence of water vapour on flame-gas temperatures.—See A., 1942, I, 400.

Radiation from flames.—See A., 1942, I, 400.

Condition of freshly burnt gases.—See A., 1942, I, 400.

Double minimum problem applied to potassium hydrogen fluoride. G. Glockler and G. E. Evans (*J. Chem. Physics*, 1942, 10, 607–609).—The doublet character of the infra-red absorption band at 3775.0 and 3664.4 cm^{-1} of solid KHF is discussed. From a plot of $\Delta h\nu_0/h\nu_0$ against the parameter q , the val. of q corresponding with the observed doublet separation ($\Delta h\nu_0/h\nu_0 = 0.03$) is 2.7; the distance ($l = 0.26 \text{ \AA}$) from the centre of the ion to the potential min. can then be calc. from $l = 5.805q/(\mu\nu_0)^{0.5}$, where $\mu = 0.982$ and ν_0 is the average fundamental frequency (3719.7 cm^{-1}). This val. of l agrees with the dimensions of the FHF' ion as obtained by other methods and supports the view that the doublet is due to the "tunnel effect." The height of the potential barrier (33,400 g.-cal. per mol.) compares favourably with the val. 32,150 g.-cal. per mol. for the potential hill intervening between two Morse curves for HF where the F—F distance equals that in KHF, viz., 2.25 \AA .
C. R. H.

Vibrational spectra of hydrocarbon molecules. V. Computation of the frequencies of the bond vibrations of olefine chains. B. I. Stepanov (*J. Phys. Chem. Russ.*, 1941, 15, 78–90; cf. Eliaschewitsch, A., 1942, I, 193).—Infra-red frequencies are calc. for straight and branched olefines. Only changes in the neighbourhood of a double bond affect the frequency due to double bond ($\sim 1650 \text{ cm}^{-1}$). Published experimental data confirm the theory.
J. J. B.

Fundamental quantities and symbols in light absorption. A. Thiel (*Z. Elektrochem.*, 1942, 48, 267–270).—The dimensions of fundamental quantities are discussed.
C. R. H.

[Photo-sensitivity of] acyclic acids.—See A., 1942, I, 404.

Spectrum of n -primary alcohols between 14,000 and 9000 cm^{-1} . J. Kreuzer (*Z. Physik*, 1941, 118, 325–339).—The absorption of n -primary alcohols in the near infra-red to $\lambda 1.1 \mu$ is compared with that of substances which give OH spectra (H_2O) and CH spectra ($n\text{-C}_6\text{H}_{14}$ and cyclohexane) only. The effect of coupling on CH frequencies is small, and separation of absorption frequencies is determined principally by constitutional differences between CH_2 and Me groups. The integral absorption in the CH region \propto the no. of CH linkages from C_1 to C_n .
L. J. J.

Absorption spectra and photochemistry, with special reference to water solutions. C. S. Forbes (*Cold Spring Harbor Symp. Quant. Biol.*, 1935, 3, 1–9).—Quinine is stable to H_2CrO_4 at $\lambda 4360 \text{ \AA}$, but decomposes at $\lambda 4050$. Photolysis of cinchonine occurs at $\lambda 3660$, but not at $\lambda 4050$. The quantum yield is a max. for quinine at $\lambda 2800$, for cinchonine at $\lambda 2540$ and for N_2O_4 at $\lambda 3360$.
CH. ABS. (e)

Chemical properties of X -ray-activated molecules with special reference to the water molecule. H. Fricke (*Cold Spring Harbor Symp. Quant. Biol.*, 1935, 3, 55–63).— X -Rays do not decompose H_2O . Reactions are caused by the activated H_2O mol., which is produced at the rate of 0.55 μ -mols. per 1000 c.c. per 1000 r. (1 r. produces an ionisation of 1 e.s.u. in 1 c.c. of air at $0^\circ/760 \text{ mm}$). The activated mol. reacts with H_2O , forming H_2O_2 and H_2 . Dosage of 1000 r. produces 2.8×10^{-6} g. ion pairs in 1000 g. of H_2O . The production of H_2O_2 from H_2O , the reduction of CrO_4^{2-} , and the decomp. of H_2O_2 , HCO_2H , and of $\text{H}_2\text{C}_2\text{O}_4$ by X -rays and by light vary with the pH and the concn. H_2O has a strong absorption band for light beginning at $\sim 1760 \text{ \AA}$.
CH. ABS. (e)

Configuration of organic co-ordination compounds of nickel, with special reference to nickel bisformylcamphor-ethylenediamine. H. S. French, M. Z. Magee, and E. Sheffield (*J. Amer. Chem. Soc.*, 1942, 64, 1924–1928).—Ni complexes from salicylaldehyde, $o\text{-COMe}\cdot\text{C}_6\text{H}_4\cdot\text{OH}$, and formylcamphor (I) are paramagnetic ($\mu 3.2$, 3.1, and 3.4, respectively). Those from salicylaldehyde, o -hydroxyacetophenoneimine, disalicylidenepropylene- $\alpha\beta$ -diamine, o -aminobenzaldimine, and di- o -aminobenzylidenephenylenediamine are diamagnetic. That from the condensation product of (I) and $(\text{CH}_2\text{NH}_2)_2$ is diamagnetic when solid, but rather feebly paramagnetic ($\mu 1.9$) in MeOH, owing, probably, to the square co-planar arrangement of the solid becoming strained and asymmetric in solution under the influence of the asymmetry of the (I) component. Absorption spectra are recorded and discussed; para- and diamagnetic compounds may perhaps be thus distinguished.
R. S. C.

Electromagnetic mechanism of the β -phosphorescence of fluorescein in acid solution. S. I. Weissman and D. Lipkin (*J. Amer. Chem. Soc.*, 1942, 64, 1916–1918).—A wide-angle interference study of the β -phosphorescence of fluorescein in H_3PO_4 at 95° K . shows that the process involves an electric dipole transition.
W. R. A.

Raman spectra of a solid peroxide, benzoyl peroxide, and a solid anhydride, benzoic anhydride. B. Susz and M. Berenstein (*Arch. Sci. phys. nat.*, 1942, [v], 24, Suppl., 182–186).—Data given for the cryst. solids are compared with those obtained by other workers

for the substances in solution. The resemblance is close, but new weak lines are present in the spectra of the solid peroxide. The spectra of the solids show ν characteristic of monosubstituted C_6H_5 derivatives, and of $\text{C}\ddot{\text{O}}$. Bz_2O has a second ν , less intense, at 1714 cm^{-1} , due to $\text{C}\ddot{\text{O}}$. The absence of this line in the spectrum of Bz_2O_2 indicates the great independence of the two $\text{C}\ddot{\text{O}}$, which no longer show resonance, and the greater symmetry of the mol.
L. S. T.

Raman effect and hydrogen bonds. V. Mixtures of acetic acid with ethers. G. V. L. N. Murty and T. R. Seshadri (*Proc. Indian Acad. Sci.*, 1942, 16, A, 50–53).—Results for AcOH -dioxan and AcOH -acetal mixtures support the mechanism proposed in previous papers (A., 1942, I, 315).
W. R. A.

Raman effect and constitution. 2 : 6-Dimethyl-4-pyrone.—See A., 1942, II, 373.

Ionisation and dissociation of electron impact: ethane, n - and iso-butane.—See A., 1942, I, 404.

Relation of dielectric properties to structure of crystalline polymers. I. Polyesters. W. A. Yager and W. O. Baker. II. Linear polyamides. W. O. Baker and W. A. Yager (*J. Amer. Chem. Soc.*, 1942, 64, 2164–2171, 2171–2177).—I. The dielectric const. (ϵ') and loss (ϵ'') were determined for the frequency interval 1 kc.—75 Mc. for polyethylene ω -hydroxypolydecoate, polydecamethylene sebacate and oxalate, and polyethylene sebacate, azelate, adipate, and succinate. Observed polarisation and dispersion are related to the orientation and concn. of polar groups in the chains and to their relative positions in adjacent chains. For all polyesters examined ϵ' is $>$ the refraction val. Oscillation of dipole groups contributes orientation polarisation; these dipoles interact chiefly between chains, thus causing broad dispersion. The polyesters exhibit high-frequency absorption with max. at low temp., indicating small oscillating units in the chains. Packing of the chains is strongly influenced by the dipoles, and formation of dipole layers makes the interaction largely independent of polar group concn. Dielectric results indicate thermal motion in the polymerides, which may explain mechanical properties such as thermal retraction associated with chain kinking in long chain mols.

II. Similar data over the same frequency range and a temp. interval of 120° were determined for polyhexamethylene sebacamide and adipamide. Dipole orientation accompanied by anomalous dispersion is exhibited even at room temp. Vals. of ϵ' and ϵ'' increase as the concn. of the polar group increases, but interaction between groups in adjacent mols. causes substantial modification. Interaction was reduced by different means and this was accompanied by enhanced polarisation. The dielectric properties show steep temp. coeffs. Polyamides have high d.c. conductivity at high temp., caused probably by mobile, charged atoms, e.g., H, resulting from isomerism in the amido-linking.
W. R. A.

Ellipsoid method of determining dielectric constants.—See A., 1943, I, 26.

Dielectric investigation of polypeptides. II. Dispersion of simple amino-acid polypeptides.—See A., 1942, I, 393.

Electric moments of inorganic halides in dioxan. II. Chlorides of boron, aluminium, iron, silicon, germanium, and tin. T. J. Lane, P. A. McCusker, and B. C. Curran (*J. Amer. Chem. Soc.*, 1942, 64, 2076–2078).—Vals. are: BCl_3 , 4.86 ± 0.07 ; AlCl_3 , 2.02 ± 0.05 ; FeCl_3 , 1.27 ± 0.05 ; SiCl_4 , 0.0; GeCl_4 , 0.67 ± 0.08 ; SnCl_4 , 3.82 ± 0.15 D. Co-ordination between dioxan and BCl_3 is almost complete but FeCl_3 shows very slight interaction. In group IV halides co-ordination increases with increasing size of the central atom.
W. R. A.

Dipole moments in the vapour state and resonance effects in substituted benzenes. E. C. Hurd and C. P. Smyth (*J. Amer. Chem. Soc.*, 1942, 64, 2212–2216).—From measurements of dielectric const., vals. of μ were calc. for: PhF , 1.57; PhCl , 1.72; PhBr , 1.77; PhI , 1.70; $p\text{-C}_6\text{H}_4\text{FBr}$, 0.5; $p\text{-C}_6\text{H}_4\text{FI}$, 0.9; $p\text{-C}_6\text{H}_4\text{FNO}_2$, 2.87; p -xylene, (0); o -xylene, 0.62; $o\text{-C}_6\text{H}_4\text{Cl}_2$, 2.51 D. The vals. for PhCl , PhBr , and PhI differ from each other by the same amount as the corresponding Bu halides. The vals. for PhCl and PhBr agree with those reported. PhI has a val. $>$ the anticipated val. $o\text{-C}_6\text{H}_4\text{Cl}_2$ gives a val. \gg that reported in literature for the vapour but agrees with the val. calc. from the solution val. after correcting for solvent. Vals. for the xylenes give 0.36 D. for the group moment produced by attaching Me to C_6H_5 . Vals. for the p -disubstituted benzenes are $>$ the differences (due to resonance) between the corresponding monosubstituted compounds.
W. R. A.

Reduction of reflexion at the surface of optical glasses. A. Smakula (*Physikal. Z.*, 1942, 43, 217–222).—Reflexion of light at an air-glass interface can be reduced by $\sim 50\%$ by a thick layer of material of suitable n on the surface. With monochromatic light reflexion can be eliminated by a suitable layer of thickness comparable with λ . The theory of the method is given, and methods of preparing the layers are proposed. The possible use of composite layers or layers of variable n is also discussed.
A. J. E. W.

Ultra-violet dispersion of air. H. Lowery (*Phil. Mag.*, 1942, [vii], 33, 622—630).—The dispersion of dry air, CO_2 not removed, was measured between 6563 and 1822 Å. by a combination of prism and diffraction grating. Results agree with previous work and lead to the Cauchy formula $(n - 1) \times 10^7 = 2882.2 + (13.53/\lambda^2 \times 10^{-8}) + (0.3064/\lambda^4 \times 10^{-16})$. O. D. S.

Effect of temperature on streaming double refraction of benzene. E. Winkler (*Z. Physik*, 1941, 118, 232—249).—The streaming double refraction in C_6H_6 was produced in a cylindrical apparatus with a fixed inner and a rotating outer cylinder. With this apparatus the streaming is laminar up to a considerable speed of rotation. The effect of temp. on the streaming double refraction was determined at various speeds of rotation, for temp. from m.p. to b.p. There is a considerable increase in the Maxwell const. of C_6H_6 between 5° and 15° . This is due to a certain degree of ordering of mols. in the neighbourhood of the m.p. The results are compared with the effect of temp. on magnetic double refraction of normal and cryst. liquids. A. J. M.

Thermodynamical notes. W. Wilson (*Phil. Mag.*, 1942, [vii], 33, 831—841).—The work of Carnot, Clapeyron, and Clausius is discussed. Thermodynamic reversibility is discussed, and a treatment of thermoelectric phenomena is given which avoids the use of conditions to ensure reversibility. Planck's statement of the second law of thermodynamics is considered. A. J. M.

Statistical mechanics. J. E. Mayer (*J. Chem. Physics*, 1942, 10, 629—643).—Mathematical. General equations dealing with distribution functions and fugacity are derived. C. R. H.

Systematic method of obtaining the relations between thermodynamic derivatives. A. Tobolsky (*J. Chem. Physics*, 1942, 10, 644—645).—A simple method, suitable for tuition purposes, of obtaining the relations between the various thermodynamic coeffs. is presented. It is readily adaptable to any desired set of independent variables. C. R. H.

Carbon-carbon bond strengths in ethane, propane, and *n*-butane. E. R. Van Artsdalen (*J. Chem. Physics*, 1942, 10, 653).—After correcting energy relations to 0°K , the following bond strengths are calc.: Me-Me 85.6 ± 2.3 ; Et-Me 83.8 ± 3.3 ; Et-Et 82.4 ± 4.5 kg.-cal., a CH_2 increment lowering the bond strength 1.5 kg.-cal. C. R. H.

Associating effect of the hydrogen atom. XI. Hydrogen bonds involving the sulphur atom. The S-H-N bond.—See A., 1943, II, 8.

Small liquid drops. II. E. Rumpf and N. Neugebauer (*Z. Physik*, 1941, 118, 317—324; cf. A., 1939, I, 140).—Measurements of min. radii for droplets of salt solutions in air streams show a dependence on the R.H. of the air. L. J. J.

III.—CRYSTAL STRUCTURE.

Thermal radiation in crystals and X-ray diffraction. J. Weigle (*Arch. Sci. phys. nat.*, 1942, [v], 24, 56—58).—The author's treatment for a simple cubic lattice, by the use of the reciprocal lattice, is generalised for all lattice types. L. J. J.

Connexion between the kinematic and dynamical theories of X-ray diffraction. H. Ekstein (*Physical Rev.*, 1942, [ii], 62, 255—261).—Mathematical. The Laue kinematic theory for very small crystals and the Darwin-Ewald theory for large crystals are deduced from limiting cases of a general integral equation. N. M. B.

Diffraction of X-rays by liquid oxygen. P. C. Sharrah and W. S. Gingrich (*J. Chem. Physics*, 1942, 10, 692).—Erratum (see A., 1941, I, 354).

Diffraction of X-rays by argon in the liquid, vapour, and critical regions. A. Eisenstein and N. S. Gingrich (*Physical Rev.*, 1942, [ii], 62, 261—270; cf. A., 1940, I, 404).—The X-ray diffraction pattern of A is obtained at 26 different conditions of pressure (0.8—51.1 atm.) and temp. (84.35 — 168°K .) with a density variation 1.401—0.038 g. per c.c. Sharp max. at high density are less marked or non-existent at low density. Results are plotted and discussed. Six liquid patterns and one vapour pattern are analysed for at. distribution. N. M. B.

Electron reflexions in MgO crystals with the electron microscope. R. D. Heidenreich (*Physical Rev.*, 1942, [ii], 62, 291—292; cf. Hillier, A., 1942, I, 319).—An electron micrograph obtained with a small objective aperture shows alternate light and dark bands. The bands occur in cubes oriented with the plane of two opposing edges normal to the paper and are due to multiple electron reflexions from the crystallographic planes. Spacings and intensity max. are discussed. N. M. B.

Crystal structure of phosphorus pentachloride. D. Clark and H. M. Powell, and (independently) A. F. Wells (*J.C.S.*, 1942, 642—645).—X-Ray oscillation photographs of PCl_5 crystals from PhNO_2 solution, protected by a coating of vaselin and medicinal paraffin, were obtained, and the structure was worked out independently. The results were in agreement, and showed that PCl_5 has a tetragonal

unit cell containing tetrahedral PCl_4^+ and octahedral PCl_6^- groups. The PCl_4^+ and PCl_6^- are arranged in a structure of the CsCl type, but distorted, since these ions are not spherical. Each complex has 8 neighbours of opposite charge. The P-Cl distance in PCl_4^+ is a little < the distance calc. from the sum of the normal tetrahedral covalent radii derived from Me compounds. A. J. M.

X-Ray investigation of the structure of lead chromate. S. B. Brody (*J. Chem. Physics*, 1942, 10, 650—652).—Simple rotation and Weissenberg equi-inclination X-ray photographs taken about the *c* and *b* axes of PbCrO_4 (crocoite) verify the lattice and space-group previously established. The *x*, *y*, *z* parameters in fractions of cell translations are Pb: 0.220, 0.150, 0.400 and Cr: 0.215, 0.150, 0.896 respectively. Accurate O parameters could not be obtained. The structure appears to be fairly close-packed and the co-ordination no. of O atoms about Pb is probably 8 or more. The mechanism of photo-conductivity and photo-blackening in PbCrO_4 is more probably due to migration through holes due to lattice defects than to migration through a perfect lattice. C. R. H.

Comparative Roentgen-ray diffraction study of natural apatites and apatite-like constituents of bone and teeth substance.—See A., 1942, III, 900.

X-Ray diffraction studies of iodinated amino-acids and proteins. M. Spiegel-Adolf, R. H. Hamilton, jun., and G. C. Henny (*Biochem. J.*, 1942, 36, 825—828).—X-Ray diffraction studies of a no. of iodinated NH_2 -acids and proteins have been made in order to discover whether the process of iodination produces any change of mol. configuration which could cause physiological activity. The substances examined were tyrosine, 3:5-di-iodo-tyrosine (I) and -thyronine, thyroxine (II), thyroglobulins (III) of human origin, iodocasein (IV), and plastein from (IV). Iodination causes some kind of structural rearrangement in the case of NH_2 -acids. X-Ray diffraction patterns of (III) of varying (II) content and of (IV) are identical with those of the I-free substances. In artificial mixtures, 2% (II) seems to be the lower limit for detection by X-ray diffraction methods; the method is not sensitive enough to detect minute amounts of (II) present in normal and pathological (III). Artificial mixtures of (I) and casein corresponding with the I content of iodinated casein show the pattern due to (I) superimposed on that of casein. Plastein made from (IV) has a pattern distinct from that of (IV). A. J. M.

Electron diffraction by silver amalgams. Z. G. Pinsker and L. I. Tatarinova (*J. Phys. Chem. Russ.*, 1941, 15, 96—100).—Evaporated Ag films kept in Hg vapour show transmission patterns of a cubic lattice (17.94 Å.) and, at a higher [Hg], two tetragonal face-centred lattices (*a* 6.93 and 9.05, *c* 5.82 and 5.62 Å.). J. J. B.

Electron-microscope study of surface structure. R. D. Heidenreich and V. G. Peck (*Physical Rev.*, 1942, [ii], 62, 292—293).—A brief description of a new technique of reproducing the surface structure of opaque bodies for examination by transmission. An impression of the surface is formed in a thermoplastic (polystyrene) and a thin film replica is made from the moulding by evaporating on to it a film of SiO_2 . N. M. B.

Disperse structure of solid systems and its thermodynamic basis. VIII. Fusion and crystallisation from the viewpoint of the theory of the coalescing conglomerates in real crystal systems. D. Balarev (*Kolloid-Z.*, 1942, 99, 157—159).—It is suggested that a crystal system always contains surface particles not conforming with the crystal structure and that at higher temp. this results in appreciable softening. This increases continuously during fusion, which occurs suddenly through the difference in the equilibrium dimensions of the free and softened elementary crystals. Fusion and crystallisation can be regarded as peptisation and coagulation processes. J. W. S.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Determination of the mol. wt. of cellulose by an end-group method. E. Husemann and O. H. Weber (*Naturwiss.*, 1942, 30, 280—281).—Mol. wts. of celluloses obtained by physical and chemical methods are compared. A polymeric-homologous series of celluloses was prepared from purified cotton-wool by progressive hydrolysis. All these contained aldehydic end-groups. They were converted into carboxylic acids without decomp. The $-\text{CO}_2\text{H}$ groups were determined by the reversible methylene-blue method, and the no. of glucose residues to one $-\text{CO}_2\text{H}$ was calc. This gives the length of chain in the mol. The degree of polymerisation of the same substances was determined by finding the η of solutions in Schweitzer's reagent. The substances were also nitrated without decomp. and the mol. wt. was determined osmotically in COMe_2 . Results of the chemical and physical methods agree satisfactorily. A. J. M.

Electrical conductivity, increase of resistance in a magnetic field, Hall effect, and superconductivity of rhenium. G. Aschermann and E. Justi (*Physikal. Z.*, 1942, 43, 207—212).—The temp.-dependence of resistance (*R*) at 0.85 — 373°K . is studied for a rod and a plate

prepared by sintering Re powder successively at 1000° and 2400°. The results may be approx. represented by the Grüneisen function ($\Theta_D = 283^\circ$, deduced from the Lindemann m.p. formula). The temp. coeff. of R at 0–100° is 0.46% per 1°. The at. resistivity at Θ_D is 12.5 Ω -cm. Transverse magnetic fields ($H > 34.3$ kg.) increase R ; at 20.4° K. and $H > 10$ kg. the ΔR - H curve is approx. linear, ΔR reaching 26.6%. The R - H relationship is represented in a reduced Kohler diagram, in which comparison is made with other elements. The Hall effect in Re is anomalous ($A_H = +3.15 \times 10^{-3}$). Re becomes superconductive at $\sim 0.95^\circ$ K. A. J. E. W.

Optical properties of 2-sulphanilamidopyrimidine (sulphadiazine). A. S. Wilkerson (*J. Amer. Chem. Soc.*, 1942, 64, 2230).—Crystals of sulphadiazine, m.p. 254°, are monoclinic, colourless, transparent to translucent; lustre vitreous. Cleavage pinacoidal at right angles, perfect. Solubility 0.0123 g. per 100 c.c. H_2O at 37°. Optically biaxial positive; α 1.680, β 1.695, γ 1.788, all ± 0.002 . W. R. A.

Physical constants of methyl isopropenyl ketone. J. H. Brant (*J. Amer. Chem. Soc.*, 1942, 64, 2224–2225).—Vals. of n_D^{20} , ρ_{20}^{20} , R , and b.p. at various pressures of the ketone are given. Ageing produces polymerisation. W. R. A.

Specific heat equations for carbon dioxide, carbon monoxide, steam, hydrogen, and oxygen, and the free energy equation for the water-gas reaction. M. de K. Thompson (*Trans. Electrochem. Soc.*, 1942, 82, *Preprint* 8, 95–100).—The least square solutions for the sp. heat equations of CO_2 , CO , H_2O , H_2 , and O_2 are worked out for $C_p = a + bT + cT^2$, $C_p = a + bT + cT^{-2}$, and $C_p = a + bT + cT^{-1}$. The form which best reproduces the observed vals. for these gases is determined. For the range 300–3500° K., the T^2 equation is best for CO and H_2O , the T^{-2} for H_2 , and the T^{-1} for CO_2 and O_2 . The equation for ΔG_0 of the water-gas reaction is computed, and the vals. of $\log K$ derived are compared with those observed experimentally (*Trans. Amer. Soc. Metals*, 1941, *preprint*). C. E. H.

Melting processes. A. Eucken (*Chemie*, 1942, 55, 163–172).—The relations between at. and mol. structure and the changes which occur when solids melt are discussed. A theory of melting based on a consideration of entropy changes is offered. C. R. H.

Density of graphite and determination of the mean coefficient of compressibility between 1 and 20,000 kg. per cm.² J. Basset (*Compt. rend.*, 1941, 213, 829–831).—The density of natural and artificial graphite measured after three compressions at 20,000 kg. per cm.² and twice degassing in vac. at 2100° has a max. val., in a natural specimen, 2.180. The mean coeff. of compressibility of this specimen at 18°, expressed as $\mu = (V - V')/V(P' - P)$ for 5000 kg. per cm.² pressure intervals, is: P 1–5000, $\mu = 4.41 \times 10^{-6}$; P 5000–10,000, $\mu = 3.27 \times 10^{-6}$; P 10,000–15,000, $\mu = 2.50 \times 10^{-6}$; P 15,000–20,000, $\mu = 1.90 \times 10^{-6}$. O. D. S.

Vapour-pressure chart for volatile hydrocarbons. R. V. Smith (*U.S. Bur. Mines*, 1942, *Inf. Circ.* 7215, 10 pp.).—Data for v.p. of hydrocarbons up to n - $C_{12}H_{26}$ have been collected and plotted, \log v.p. being plotted against temp. A. J. M.

Correlating vapour pressure and latent heat data. Use of critical constants. D. F. Othmer (*Ind. Eng. Chem.*, 1942, 34, 1072–1078).—At const. reduced temp. the reduced v.p. (P_r) and reduced latent heat ($L_r = \text{latent heat}/T_c$) of any substance is such that $\log P_r/L_r = k$, a const. independent of the substance considered. Nomograms to facilitate calculations from this relation are presented. J. W. S.

Effect of temperature on the surface tension and density of halogen-substituted acetic acids. J. J. Jasper and L. Rosenstein (*J. Amer. Chem. Soc.*, 1942, 64, 2078–2079).—For the ranges 55–170° and 85–130° the vals. of ρ and of γ for CH_3Br - CO_2H and CH_3I - CO_2H are given by: $\rho = 1.93302 - 0.0016482\theta$ and $2.41128 - 0.0017837\theta$; $\gamma = 46.20552 - 0.10901\theta$ and $48.35779 - 0.11483\theta$. W. R. A.

Equation of state of gases. III. S. S. Vassiliev (*J. Phys. Chem. Russ.*, 1941, 15, 239–245; cf. A., 1941, I, 459).—The consts. a and b of van der Waals' equation are linear functions of temp., increasing with increasing T above $T_{crit.}$ and with decreasing T below $T_{crit.}$. J. J. B.

Equation of state for gases at high pressures involving only critical constants. S. H. Maron and D. Turnbull (*J. Amer. Chem. Soc.*, 1942, 64, 2195–2198).—An extension to other gases of the equation of state for N_2 (A., 1942, I, 139). The equation, based on the principle of corresponding states, requires only the crit. temp. and pressure of a gas and for pressures up to 1000 atm. and reduced temp. > 1.55 . It also applies for reduced temp. 1.30–1.55 and pressures of ~ 100 atm., and is superior to other common equations of state. A generalised equation for the compressibility coeffs. of gases is deduced. W. R. A.

Partition function of a gas of hard elastic spheres. O. K. Rice (*J. Chem. Physics*, 1942, 10, 653–654).—Tonks' equation of state (cf. A., 1938, I, 71) of a one-dimensional gas is discussed and a new interpolation formula to bridge the gap between two of Tonks' equations is suggested as giving a better interpolation than Tonks' original interpolation formula. C. R. H.

Partition function of a simple liquid. O. K. Rice (*J. Chem. Physics*, 1942, 10, 654).—If atoms are removed from a face-centred cubic solid, which is regarded as resembling a close-packed gas of hard spheres, the resulting model can be regarded as representing a liquid, the holes previously occupied by atoms contributing to the free vol. Considering only thermal energy, the equations dealing with the partition function of a gas (cf. preceding abstract) have been extended to the case of such a liquid. The author claims that such a model gives a better indication of the behaviour of liquid A. C. R. H.

Thermal conductivity and thermoelectric, galvanomagnetic, and thermomagnetic effects of isotropic metals in transverse magnetic fields. M. Kohler (*Z. Physik*, 1941, 118, 37–47).—Mathematical. W. R. A.

Thermal conductivity of fluorochloro-derivatives of methane in liquid state. R. Plank (*Z. ges. Kälte-Ind.*, 1942, 49, 47; *Chem. Zentr.*, 1942, II, 1210).—The following expression is derived for the thermal conductivity (k) (kg.-cal./in.²/°C./hr.) at 20° of compounds $CH_2F_nCl_{3-n}$, viz., $k = 0.157 - 0.03y - 0.017z$, or $0.089 + 1.017x - 0.013y$. R. B. C.

Thermal conductivity of liquid metals. M. R. Rao (*Indian J. Physics*, 1942, 16, 155–159).—The abrupt decrease in the thermal conductivity of metals near the m.p. is explained by assuming that the mol. vibration frequency changes near the m.p. The ratio of conductivities in the solid and liquid phases near the m.p. is given by $e^{2\lambda_m/3k_0T_m}$, where k_0 is the Boltzmann const. and λ_m/T_m is the entropy of melting. This accords with observation. The slight decrease in conductivity in the liquid phase is ascribed to the disordered state of the liquid. N. M. B.

Thermal conductivity of liquids. M. R. Rao (*Indian J. Physics*, 1942, 16, 161–167).—A detailed account of results previously reported (cf. A., 1941, I, 330). The revised val. of the const. in the formula is 2.096×10^5 . Calc. vals. of K for 13 liquids agree fairly well with observed vals. K is intimately connected with the free vol. of the liquid at the m.p. N. M. B.

Random reorganisation of mol. wt. distribution in linear condensation polymers. P. J. Flory (*J. Amer. Chem. Soc.*, 1942, 64, 2205–2212).—Individual mols. exist only temporarily when heated to a suitable temp. owing to ester interchange between an ester group of one polymer mol. and the terminal functional group of another. Such processes have no effect on the no. average degree of polymerisation but they may modify the distribution of species. These considerations lead to the concept of an entropy of heterogeneity and the same equilibrium size distribution as that obtained directly by random poly-condensation. The changed distribution of species in a mixture of polyesters was observed by η measurements and agrees with theoretical predictions. Conversion of a cyclic ester (lactone) into a linear polyester should yield a much narrower distribution of species than is obtained by polycondensation, but if ester interchange occurs between the polymer mols. subsequent to their initial formation, the distribution will be broadened. W. R. A.

Viscosity and cryoscopic data on polystyrene; Staudinger's viscosity rule.—See A., 1942, I, 397.

Frictional phenomena. VI.—See A., 1942, I, 412.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Theory of the viscosity of liquid mixtures. A. G. Stromberg (*J. Phys. Chem. Russ.*, 1941, 15, 205–219).—Andrade's theory (cf. A., 1934, 356) is extended to mixtures of liquids. The new theory accounts for all the known types of the viscosity-composition curves and, qualitatively, also for the variation of their shape with temp. J. J. B.

Viscosity-concentration relationships in concentrated solution. V. R. Houwink and K. H. Klaassens. VI. Significance of the viscometric "extension factor." H. L. Bredée and J. de Booy (*Kolloid-Z.*, 1942, 99, 160–171, 171–189; cf. A., 1940, I, 290).—V. The validity of the formula $\log \eta_r = KC_v^a$ where η_r is the relative viscosity, C_v the dry vol. concn. of the dispersed substance, a a "stretching factor," and K a const., is discussed with reference to a no. of systems, and compared with that of the formula of Bredée and de Booy (A., 1937, I, 303). Below a limiting concn., $a = 1$ in the above equation. In certain circumstances (but not always, as assumed previously), a is a measure of the length of the dispersed colloidal particles; the smaller is a , the greater is the particle length. The variations in the vals. of a are considered to be due to differences in the density of packing of the dispersed particles.

VI. A review of the literature, with particular reference to the inter-connexion between the two viscometric factors contained in the von Bredée-de Booy equation (A., 1937, I, 303), and their variation with concn. N. G.

Electrolytic study of linear diffusion of silver salts. H. A. Laitinen (*Trans. Electrochem. Soc.*, 1942, 82, *Preprint* 9, 101–108; cf. A., 1940,

I, 106).—The theory of diffusion is applied to the case of a single metal salt being electrolysed to the metal, with diffusion occurring in a linear column, and assuming virtually complete concn. polarisation of the cathode. The theoretical current-time relationship is applied to the diffusion of AgNO_3 , Ag_2SO_4 , and AgOAc , and compared with experimental data. The diffusion of pure Ag salt solutions is compared with that of Ag ions in the presence of excess of an indifferent ionised salt. The effect of the latter is analogous to the suppression of the migration current in polarographic current-voltage curves. C. E. H.

Effect of impurities on crystallisation. V. K. Sementschenko and L. P. Schischobalova (*Min. Suir.*, 1936, 11, No. 6, 27–31).—The surface tension (γ) of NaNO_3 , with and without the addition of salts, was studied at 315–560° by a modification of the Jaeger method. The changes produced by $\geq 30\%$ of KCl, NaCl, NaI, and NaF were within the experimental error (0.5–2.0%). Surface-active substances (KOAc and EtCO_2K) considerably diminish γ . The halides have little effect on crystallisation, but KOAc and EtCO_2K produce a greater degree of dispersion of the cryst. aggregates than that in pure NaNO_3 . CH. ABS. (e)

Vapour pressure nomographs for aqueous sodium hydroxide solutions. D. S. Davis (*Ind. Eng. Chem.*, 1942, 34, 1131–1132).—From the data of Åkerlöf and Kegerles (*A.*, 1940, I, 214) nomographs have been constructed to permit calculation of the v.p. of NaOH solutions over the concn. ranges 1–17N. and 0.1–7N., respectively. J. W. S.

Specific heat of concentrated aqueous lithium, sodium, and potassium chlorides. A. J. Bogorodski and G. P. Dezideriev (*Trans. Kirov Inst. Chem. Tech. Kazan*, 1935, No. 4–5, 29–40).—Data are recorded for LiCl 11.4–36.68, NaCl 7.42–26, and KCl 6.95–24.8% at 16–34°. CH. ABS. (e)

Raman effect of aqueous solutions of potassium hydrogen fluoride and hydrofluoric acid. L. A. Woodward and H. J. V. Tyrrell (*Trans. Faraday Soc.*, 1942, 38, 513–517).—Apparatus of polished Ag suitable for use with solutions containing HF is described. No Raman effect is obtained with 3.5M-KHF₂, a result which supports Pauling's view that the H-bonds involved are largely ionic. With 40% aq. HF a heavy continuous spectrum, which appeared to be due to fluorescence, was obtained, and no Raman lines could be observed. F. L. U.

Viscosity of the system SiO_2 -PbO. A. S. Konovalov and K. S. Evstropiev (*J. Phys. Chem. Russ.*, 1941, 15, 109–115).—The η of 9 glasses with between 67 and 90 wt.-% of PbO between 580° and 1460° can be expressed by the relation $\log \eta = -A + a/T^2$, T being the abs. temp. and A and a consts. A decreases and a increases with the % of SiO_2 ; it is doubtful whether they show kinks at the compositions PbSiO_3 and Pb_2SiO_4 . The equation is valid also for sheet glass (Fourcault). J. J. B.

Viscosity of the system Na_2SiO_3 - SiO_2 in molten state. M. M. Skorniakov, A. J. Kuznetsov, and K. S. Evstropiev (*J. Phys. Chem. Russ.*, 1941, 15, 116–124).—The η of 13 glasses containing 22–50 mol.-% of Na_2O is expressed between 760° and 1420° by $\log \eta = -A + a/T^2$ (cf. preceding abstract). A increases with $[\text{Na}_2\text{O}]$, a increases with $[\text{SiO}_2]$, and both show a kink at the composition $\text{Na}_2\text{Si}_2\text{O}_5$. No singular point marks the composition $\text{Na}_2\text{O} \cdot 3\text{SiO}_2$. J. J. B.

Viscosity of glasses of the system $\text{Na}_2\text{Si}_2\text{O}_5$ - PbSiO_3 in the region of the softening temperature. B. A. Pospelov and K. S. Evstropiev (*J. Phys. Chem. Russ.*, 1941, 15, 125–133).— η is calc. from the rate of extension of a hanging glass fibre. In the steady state η is identical for annealed and unannealed glass. The expression $\log \eta = -A + a/T^2$ (cf. preceding abstracts) is valid between $\eta = 10$ and $\eta = 10^{15}$ poises, but the vals. of A and a are different for the regions of η 10–10⁷ and 10⁷–10¹⁵ or, for other glasses, 10–10⁴ and 10⁴–10¹⁵ poises. At high temp. η increases with $[\text{Na}_2\text{O}]$, and at low temp. shows a min. at the composition $\text{Na}_2\text{Pb}_2\text{Si}_4\text{O}_{11}$. J. J. B.

State of diffusion of hydrogen in pure iron.—See B., 1942, I, 525.

Decomposition of β in aluminium-zinc alloys and effects of small additions of other elements on rate of decomposition. E. Gebhardt (*Z. Metallk.*, 1941, 33, 328–332).—Dilatometric, thermal, resistance, and hardness measurements on a 21% Al-Zn alloy during the breakdown of β and X-ray examination of the structure indicate that this phase decomposes at 272° directly into β' and η . Additions of Sn, Cu, In, Li, and Mg retard this decomp., the effect increasing in the order given. Decomp. of β in quenched ternary alloys containing any of these elements proceeds as a quasibinary reaction without the establishment of an equilibrium as long as any β remains. A. R. P.

Systems zinc-cerium and zinc-lanthanum. J. Schramm (*Z. Metallk.*, 1941, 33, 358–360).—Alloys with up to 40% of Ce or La were examined by thermal and micrographic methods. Solid Zn dissolves only traces of either metal and the eutectics are very close to the Zn end of the system. CeZn_{11} and LaZn_{11} are formed by peritectic reactions at 785° and 852° respectively, and CeZn_6 and LaZn_6 melt congruently at 972° and 962° respectively. Alloys

with 22–40% Ce undergo, during cooling from liquid, three-phase reactions of undetermined nature at 942°, 870°, 840°, 817°, and 790° accompanied by evolution of heat; similar reactions occur in the La system at 930°, 852°, and 750°. X-Ray examination revealed two new phases in alloys of both systems containing 60–70% of Zn. A. R. P.

Partial systems of zinc with titanium and zirconium. E. Gebhardt (*Z. Metallk.*, 1941, 33, 355–357).—Alloys of Zn with up to 5% of Ti and up to 3% of Zr were investigated by thermal analysis and micrography. The eutectic points are at 418°, 0.45% Ti, and 416°, 0.1% Zr. Peritectic reactions occur in the Ti system at 460° and 490° and in the Zr system at 545° and 970°. Zn dissolves 0.02% of Zr and only a trace of Ti at 400°. A. R. P.

Alloys of thorium with copper, aluminium, and sodium. G. Grube and L. Botzenhardt (*Z. Elektrochem.*, 1942, 48, 418–425).—The systems Cu-Th and Al-Th ($\geq 50\%$ Th) and Na-Th ($\geq 80\%$ Th) have been studied by thermal analysis. The compounds Cu_4Th and Na_4Th and an Al-Th compound, possibly Al_7Th , all with incongruent m.p., have been shown to exist. Near the m.p. solid Cu and Al dissolve 4.5 and 2.3% of Th, respectively. The age-hardening of the alloys of low Th content has been studied at various temp. J. W. S.

Solidus temperatures in the systems iron-tungsten and iron-molybdenum. W. P. Sykes (*Trans. Amer. Soc. Met.*, 1936, 24, 541–550).—Data are recorded. Micro-structures of drastically quenched specimens indicate that in both systems the α phase is formed in the peritectic reaction: liquid + $\epsilon \rightleftharpoons \alpha$. CH. ABS. (e)

Partial system nickel-NiAl. J. Schramm (*Z. Metallk.*, 1941, 33, 347–355).—Alloys with up to 25% Al were examined by thermal, micrographic, X-ray, and magnetic methods; only three phases, α , α' , and β , exist in this range. The peritectic reaction $\alpha + \text{liquid} \rightleftharpoons \alpha'$ occurs at 1362°, the horizontal extending from 10.5 to 12.5% Al, and the eutectic reaction $\text{liquid} \rightleftharpoons \alpha' + \beta$ at 1360°, the horizontal extending from 12.5 to 16% Al. At room temp. Ni dissolves 4.6% Al, the β phase contains a max. of 25% Al, and the α' phase covers the range 12.6–14.4% Al and is non-magnetic. Pptn.-hardening occurs on reheating quenched α -alloys with 5–10% Al and β -alloys with 15–25% Al. A. R. P.

Structure and volume changes of zinc-copper-aluminium alloys. I. Phase fields of the concentration plane at 300°. II. Relation between CuAl and the ternary crystal phase. W. Köster and K. Moeller. III. Equilibria in the system copper-aluminium-zinc. W. Köster. IV. Causes of the volume changes and a method of obtaining volume stability. E. Gebhardt (*Z. Metallk.*, 1941, 33, 278–283, 284–288, 289–296, 297–305).—I. Equilibria in the 350° isothermal plane were established by X-ray and micrographic methods. The system contains a ternary compound phase (T) with Cu 56–58 and Zn 10–30%; it forms large polygonal crystals after annealing at 600° and has a body-centred cubic lattice of the W type when the Al is $\geq 20\%$ and a CsCl type lattice with superstructure when the Al is $\geq 20\%$ (T' phase). T is probably $\text{Cu}_{10}\text{Al}_6\text{Zn}_4$ and T' $\text{Cu}_{17}\text{Al}_{17}\text{Zn}_6$; both compounds have $\sim 2:1$ valency electron-atom ratio, form the primary crystallites over a wide concn. range, and can exist in equilibrium with γ , η , θ , and α Cu-Al phases and with β , γ , and ϵ Cu-Zn phases. The γ phases of the Cu-Al and Cu-Zn systems merge into a ternary γ containing a max. of 3% Zn and passing into γ_2 towards the Al side. The ($\gamma + \eta$) and the η fields of the Cu-Al system extend to 12% Zn in the ternary system, the θ (CuAl_2) phase takes $\geq 2\%$ of Zn and the ϵ (Cu-Zn) phase $\sim 2\%$ of Al into solid solution, and the ($\gamma + \eta + T$) and ($\theta + \eta + T'$) fields are relatively small triangles. The two large three-phase fields ($\alpha_{\text{Al}} + \theta + T$) and ($\alpha_{\text{Al}} + T' + \epsilon$) are triangles covering the ranges Cu 1.5–56, Al 65–34, Zn 33.5–2%, and Cu 1.5–18, Al 31.5–2, Zn 12.5–80% respectively. There are also an elongated ($T + \gamma + \epsilon$) field in the range Cu 56–27, Al 13–3, Zn 31–70%, and a small ($\alpha_{\text{Cu}} + \beta + \gamma$) field near the Cu corner. Two-phase fields are $\gamma + \eta$, $\gamma + T$, $T' + \eta$, $\theta + \eta$, $\theta + T'$, $\alpha_{\text{Al}} + \theta$, $\alpha_{\text{Al}} + T'$, $\alpha_{\text{Al}} + \epsilon$, $T + \epsilon$, $\gamma + \epsilon$, $\beta + \gamma$, $\alpha_{\text{Cu}} + \beta$, $\alpha_{\text{Cu}} + \gamma$.

II. Equilibria between γ , η , θ , and T phases in Al-Zn-Cu alloys with 55–80% Cu have been determined up to 900°; η and T form a continuous series of solid solutions at high temp. which separate below 630° (Zn 7.5, Al 21.5%) to 540° (Zn 6, Al 30%) into two phases ($T + \gamma$ or $T' + \theta$). In equilibrium with γ the Zn content of η and T increases and the Cu content decreases with fall in temp. below 500°, whilst in equilibrium with θ the Zn content of T' increases, that of η decreases slightly, and the Al content of both η and T remains const. The η phase exists in three forms, the change from η_2 through η_1 to η with rise in temp. being accompanied by increases in the symmetry of the lattice. The superstructure lines of the T' lattice become more distinct with rise in temp. and with increase in Zn content. Zn thus appears to render the high-temp. modifications of the Cu-Al phases more stable at lower temp.

III. A complete space model and various sectional diagrams have been constructed to show the equilibria in the Cu-Al-Zn system at temp. up to the m.p. of the alloys. Addition of Zn lowers the eutectic temp. of the Cu-Al system since the α_{Al} phase can dissolve

up to 60% of Zn and the θ phase 2% of Zn at the m.p. The eutectic equilibrium in the Cu-Al system merges with the peritectic equilibrium at 596° in the Cu-Zn system to give the peritectic reaction: liquid (Cu 15, Al 25%) + θ (Cu 52, Al 46%) \rightleftharpoons α (Cu 2, Al 33%) + T (Cu 55.5, Al 31.5%) at 420°; at lower temp. Zn separates from the α phase, only 5% being retained at 100°. Some alloys can thus be two-phase at high and low temp. and three-phase at intermediate temp. Another four-phase reaction occurs at 396°, viz.: liquid (Cu 10.5, Al 15.5%) + T (Cu 55.5, Al 30.5%) \rightleftharpoons α (Cu 1.8, Al 26.2%) + ε (Cu 23, Al 5%), and a third at 275°, viz.: α (Cu 1, Al 24%) + ε (Cu 17.2, Al 0.3%) \rightleftharpoons T (Cu 56, Al 32%) + Zn (Cu 1.7, Al 0.8%). In alloys with 30–60% of Cu a true ternary peritectic reaction occurs at 625°, viz.: liquid (Cu 32, Al 15%) + T (Cu 57.5, Al 17.5%) + δ (Cu 53, Al 13%) \rightleftharpoons ε (Cu 52, Al 14%). The ternary eutectoid reaction δ (Cu 48, Al 9%) \rightleftharpoons γ (Cu 48, Al 7%) + ε (Cu 44, Al 8%) + T (Cu 56, Al 13%) occurs at 480°.

IV. The vol. changes which occur during storage of Zn-base alloys containing Cu and Al are due to four causes, viz.: (a) decomp. of β into an Al-rich and a Zn-rich phase with a contraction of 1.1% in vol., (b) the reaction $\beta + \varepsilon \rightleftharpoons \eta + T$ which normally occurs at 275° but, if suppressed, occurs over a period of months at room temp. accompanied by a vol. expansion of 4%, (c) pptn. of excess of solute from the four phases mentioned in (b) with a vol. change of 0.1%, and (d) structural changes due to deformation. All the vol. changes are prevented by annealing at 240–260° for 40 hr. to complete reactions (a) and (b) and then either cooling very slowly or re-annealing at 100–150° for several hr. This treatment improves the hardness and impact val. of the alloys. A. R. P.

Iron-nickel-aluminium phase diagrams.—See B., 1942, 1, 527.

Polymorphism and miscibility in the isomorphous group dibenzyl, stilbene, tolane, and azobenzene. A. Kofler and M. Brandstätter (*Z. physikal. Chem.*, 1942, A, 190, 341–360).—The systems (CHPh)₂, (NPh)₂, and (CPh)₂ show complete miscibility of Roozeboom's type I whilst the system (NPh)₂–(CPh)₂ is of type III. (CH₂Ph)₂ is completely miscible with the other compounds only when they are in their unstable β forms, so the phase diagram shows discontinuities with regions of incomplete miscibility. J. W. S.

Adsorption potentials at gas-solid interfaces. * A. A. Frost (*Trans. Electrochem. Soc.*, 1942, 82, Preprint 10, 109–113).—An improved apparatus (cf. A., 1941, I, 108) for the study of potentials due to gas adsorption at solid surfaces consists essentially of two parallel brass plate electrodes connected in series with a potentiometer and an electrometer. One electrode is uncoated, and the other coated in turn with dicetyl, paraffin, stearic acid, colloidal graphite, nitrocellulose, collodion, and vinylite. Air saturated with the vapour under investigation is drawn into the cell and the potential between the two electrodes observed. The potentials are highly sp. with respect to both the vapour and the adsorbing surface. Possible applications are suggested. C. E. H.

Accommodation coefficient of mercury on platinum and the heat of vaporisation of mercury. L. B. Thomas and F. G. Olmer (*J. Amer. Chem. Soc.*, 1942, 64, 2190–2195).—The accommodation coeff. of Hg on Pt, measured at low pressures of Hg, approaches 1 as the temp. difference between the filament and the wall approaches 0 but decreases by ~0.08 for each 100° of the temp. difference. From these data the heat of vaporisation of Hg has been calc. as 14,920 g.-cal. W. R. A.

Rate of molecular sorption on active charcoal. A. Shuchovitzki, J. Zabeshinski, and A. Venitschkina (*J. Phys. Chem. Russ.*, 1941, 15, 174–183).—Theoretical considerations based on the analogy between diffusion and heat transfer and experimental data (higher rate of adsorption of Et₂O diluted with H₂ than when diluted with air) show that external diffusion to charcoal grains is more important than internal diffusion within their pores. J. J. B.

Applicability of the radioactive indicator method to determining the surface of solid materials. L. L. Imre (*Kolloid-Z.*, 1942, 99, 147–157).—Relationships expressing the adsorption at solid-liquid phase boundaries are derived from statistical mechanical considerations. It is shown that Paneth's equation for exchange adsorption has only a limited validity. The theory is supported by data for the exchange adsorption of Th-B on PbSO₄ from aq. or EtOH solution. J. W. S.

Equilibrium and surface phenomena in the systems phenol-formic acid-water and phenol-acetic acid-water. II. K. M. Golubkova, N. N. Petin, and K. V. Toptschieva (*J. Phys. Chem. Russ.*, 1941, 15, 198–204; cf. A., 1936, 25).—PhOH and H₂O become completely miscible in presence of about 4 mol.-% of AcOH or 10 mol.-% of HCO₂H. The H₂O and acid content of the co-existing layers and their electric conductivity are determined. The surface tension of these layers is almost independent of concn. and the interfacial tension between the layers increases when the difference in composition of the layers decreases. J. J. B.

Contact angles at liquid-liquid-air interfaces. W. Fox (*J. Chem. Physics*, 1942, 10, 623–628).—An air bubble in a hollow glass tube (3 mm. internal diameter) is brought down to the interface of two

liquids and the angles of contact where the interfaces meet are measured from photographs of the bubble so formed. The various angles of contact for the systems air-H₂O-NH₂Ph, -PhNO₂, -CCl₄, -CHCl₃, -C₆H₆, and -Et₂O have been determined. Calculations of the work of adhesion (W) between any two liquids in presence of a gas phase have been made. To explain spreading in a sp. gas phase it is only necessary to compare W for the gas to the liquid on which the spreading is to take place with W for the two liquids in presence of the same gas. If the free energy change is negative, spreading will occur in that direction which will give a negative free energy change. C. R. H.

Electric determination of film-volume and film-density. H. Löwy (*Phil. Mag.*, 1942, [vii], 33, 772–774).—Equations concerning the covering of rock particles by films of H₂O are given. The dielectric const. of the soil in the Western Desert of Egypt after a rainy day is given for different days, and the film-vol. is calc. The fact that film thickness is independent of the size of the solid particle covered is confirmed. A. J. M.

High mol. wt. aliphatic amines and their salts. VIII. Soluble and insoluble films of amine acetates. A. Surface tension of aqueous solutions of dodecylamine acetate. E. J. Hoffman, G. E. Boyd, and A. W. Ralston (*J. Amer. Chem. Soc.*, 1942, 64, 2067–2070).—The variation of γ with concn. for solutions of dodecylamine acetate has been investigated at various temp. and a time effect was observed only at 25° in one solution below the crit. concn. for micelle formation. Unilayers of octadecylamine acetate are too sol. to permit their investigation by the film balance, but films of docosylamine acetate spread on aq. AcOH have been studied. Rise in temp. causes these films to become more expanded and the calc. heat of spreading at an area of 35 sq. A. per mol. is 140 ergs per sq. cm. W. R. A.

Steric factor in the permanganate oxidation of triolein monolayers. R. Mittelmann and R. C. Palmer (*Trans. Faraday Soc.*, 1942, 38, 506–513).—The rate of increase of area at const. pressure of monolayers of triolein spread on 0.0025N-KMnO₄ (pH 1) (cf. Hughes and Rideal, A., 1933, 679) follows a first order law between 1 and 14 dynes per cm., is \propto [KMnO₄], and increases with decreasing pH of the substrate. On the assumption that the observed expansion is a measure of the rate at which double linkings make contact with the surface of the liquid, a simple model is described, on the basis of which an expression for the force-area curve of triolein is derived. This expression, which contains no arbitrary consts., is in reasonable agreement with the measurements. F. L. U.

Radial spreading of organic liquids on water surfaces. W. von Guttenberg (*Z. Physik*, 1941, 118, 22–26).—Small drops of oleic, linoleic, and linolenic acids on H₂O spread to give circular films. The films were photographed, after dusting with lycopodium powder, by a technique which is described. All acids behave similarly. The velocity of spreading is related to the radius of the film. W. R. A.

Structure of collodion membrane and its electrical behaviour. IV. Relative merits of homogeneous phase theory and micellar-structural theory as applied to the dried collodion membrane. K. Sollner and C. W. Carr (*J. Gen. Physiol.*, 1942, 26, 17–25; cf. A., 1942, I, 171).—Dried collodion membranes prepared from an electrochemically inactive collodion prep. have characteristic low (~30 mv.) concn. potentials. After activation by oxidation to give max. or nearly max. concn. potentials (~50 mv.), the membranes are dried, dissolved in EtOH-Et₂O, and a new set of membranes is prepared from this solution. These have low concn. potentials, and since the properties of a homogeneous phase should be uninfluenced by rearrangement of its constituent particles, the results do not support the homogeneous phase (solubility) theory, but agree with the micellar-structural theory. J. N. A.

Methods for determining particle size distribution.—See B., 1942, I, 490.

Macromolecular compounds. CCXCVI. Viscosity measurements on esters with unbranched and branched chains. CCXCVII. Determination of the chain-length of polyamides. H. Staudinger and H. Jörder (*J. pr. Chem.*, 1942, [ii], 160, 166–175, 176–194).—CCXCVI. The relationship $Z_\eta = Kn$, where Z_η is the viscosity no. (limiting val. of the ratio sp. viscosity/concn. as the concn. \rightarrow 0), n is the no. of C atoms in the chain mol., and K is a const. which varies only with the solvent so long as the mols. are equally solvated, holds equally well for straight-chain mols. and parallel- or branched-chain mols., e.g., esters of glycerol and of octadecane-1:12-diol. The vals. of K for various solvents are: C₆H₆, 0.93, CCl₄, 1.07, COMe, 1.0, and *m*-cresol 0.54×10^{-4} . With *m*-cresol, however, short-chain mols. give rather low vals. of K .

CCXCVII. In C₆H₆, CCl₄, CHCl₃, and AcOH, amides show anomalously high vals. of Z_η , attributable to the existence of a high dipole moment. These can be expressed $Z_\eta = Kn + \gamma/a$, where a is the no. of C atoms per CO-NH₂ group, but γ is not const., decreasing with increasing vals. of n and of a , becoming 0 for CHCl₃ solutions when $n/a < 4$. Hence the chain-length of amide poly-

merides can be determined from η measurements on CHCl_3 solutions, for which $K = 1.14 \times 10^{-4}$. J. W. S.

Macromolecular compounds. CCXCIX. Fibrillar structure of natural and artificial cellulose fibres. M. Staudinger (*J. pr. Chem.*, 1942, [ii], 160, 203—216).—Fresh ramie and cotton fibres and fibres of which the cellulose has been degraded to various extents by treatment with 1% H_2O_2 in 2% NaOH show similar appearances under the microscope and have similar X-ray spectra. After hammering or pressing, however, the degraded forms show more shattering, an extreme case being that of fibres from mummy wrappings. Flax fibres show similar behaviour but synthetic fibres differ in that secondary structures are set up on degradation. J. W. S.

Structures of substituted natural celluloses.—See B., 1942, II, 427.

"Water-soluble" cellulose. T. Lieser (*Kolloid-Z.*, 1942, 98, 142—148).—Cellulose (I), being a polyhydroxyvinyl compound, should be readily sol. in H_2O . The fact that it is a high polymer should not affect its solubility. It also contains hydrophilic (OH) groups. The structure of the (I) mol. in relationship to its solubility, and the solubility of cellulose-A in alkalis, are discussed. A dil. aq. solution of (I) (1:1000) was prepared by dialysing a dil. aq. solution of cellulose ditetraethylammonium trixanthate into H_2O until all xanthate groups were hydrolysed. The solution is considered to contain isolated macromols. of (I). Such solutions are very unstable, the rate of pptn. depending on concn., temp., and degree of polymerisation. The more highly polymerised is the (I) the more rapidly does it ppt. The properties of (I), such as its insolubility, rigidity, and elasticity, are dependent equally on the supermol. or micellar structure, and on the macro-mol. structure. A. J. M.

Preparation and properties of protein sols. II. Sols with *l*-histidine, *d*-arginine, *l*-proline, and *l*-hydroxyproline. C. Wunderley (*Helv. Chim. Acta*, 1942, 25, 1053—1063).—The prep. of four protein systems is described whereby euglobin is used as protein component and the NH_2 -acid component is *l*-histidine, *d*-arginine, *l*-proline, or *l*-hydroxyproline. The colloidal dissolution processes of the systems are characterised by their solution dispersivity, intensity, and solution capacity of the peptiser. The inner surface of the protein aggregates is measured by their dissolving power and degree of depolarisation. In the region under investigation the Rayleigh light is exactly \propto the protein concn. whilst the degree of depolarisation is independent thereof. H. W.

VI.—KINETIC THEORY. THERMODYNAMICS.

Solvent effects in association equilibria. A. Wassermann (*J.C.S.*, 1942, 621—623).—Solvent effects in the thermal equilibrium const. of $2(\text{NPh}_2 \cdot \text{NBz}) \rightleftharpoons (\text{NPh}_2 \cdot \text{NBz})_2$, which was shown by Goldschmidt and Bader (A., 1929, 1173) to be $\text{Be} \Delta H/RT$, are represented by a linear relation between $\log B$ and ΔH . F. R. G.

Ion-solvent interaction and individual properties of electrolytes. K. Fajans and O. Johnson (*Trans. Electrochem. Soc.*, 1942, 82, *Preprint* 16, 161—175).—Present knowledge of the structure of solutions of strong electrolytes, especially as given by refractometric data, is summarised and discussed. The resultant of forces between neighbouring ions and between ions and solvent which predominates at high concns. and the interaction of free ions and solvent which predominates at low concns. are shown to be the two principal factors involved. C. R. H.

Extension of the acidity scale. L. Michaelis and S. Granick (*J. Amer. Chem. Soc.*, 1942, 64, 1861—1865).—In a bivalent reversible system there are three levels of oxidation-reduction, viz., reduced (*R*), semi-oxidised (*S*), and completely oxidised forms (*T*). If the normal potentials for the $R \rightarrow S$, $S \rightarrow T$, and $R \rightarrow T$ systems are E_1 , E_2 , and E_m , then $E_m = (E_1 + E_2)/2$. All vals. of E depend on pH, and $E_2 - E_1$; the "spread," also depends on pH. Using hydroxythiazine, aminothiazine, and thionine, the pH scale for aq. H_2SO_4 up to 11M. has been extended by considering the relation between pH and the spread of E_m for the dyes. The vals. deduced agree closely with those given by Hammett. W. R. A.

Study of electrolytic dissociation in iodic acid by Raman effect. N. R. Rao (*Indian J. Physics*, 1942, 16, 71—76).—In conc. solutions the dimeride (HIO_3)₂ exists but on dilution breaks down. Lines are identified with mol. species of HIO_3 and with IO_3' ion. In 0.1N. solutions the IO_3' line from HIO_3 is less intense than that from KIO_3 , hence HIO_3 is not completely dissociated at that dilution. W. R. A.

Relative strengths of formic, acetic, and propionic acids in alcohols and dioxan-water mixture. M. Kilpatrick and R. D. Eanes (*J. Amer. Chem. Soc.*, 1942, 64, 2065—2067).—The log acid strength of HCO_2H relative to AcOH and of EtCO_2H relative to AcOH in dioxan- H_2O is not $\propto 1/\epsilon$, where ϵ is the dielectric const. of the medium. In H_2O , MeOH , EtOH , and $(\text{CH}_2\text{OH})_2$ the relationship is linear. W. R. A.

Isoelectric points of threonine and some related compounds. C. S. Vestling and D. T. Warner (*J. Biol. Chem.*, 1942, 144, 687—690).—

From the results of electrometric titrations with 0.1N-HCl and -NaOH at 25° and total ionic strength 0.1, the apparent dissociation consts. and isoelectric points of *l*-threonine, *dl*-O-methylthreonine, *dl*-O-methylallothreonine, and *dl*- $\text{NH}_2 \cdot \text{CHEt} \cdot \text{CO}_2\text{H}$ have been calc. These vals. are compared with data for related compounds. J. W. S.

Thermodynamic properties of solutions of amino-acids and related substances. VII. Ionisation of some hydroxylamino-acids and proline in aqueous solution at 1—50°. P. K. Smith, A. T. Gorham, and E. R. B. Smith (*J. Biol. Chem.*, 1942, 144, 737—745).—From e.m.f. measurements on cells without liquid junctions the thermodynamic ionisation consts. of *dl*-serine, *dl*-threonine, *dl*-allothreonine, *l*-hydroxyproline, and *l*-proline have been determined at 1—50°. The vals. of the thermodynamic functions for the ionisation are derived. J. W. S.

State of order in liquid electrolyte solutions. H. Fällkenhagen (*Physikal. Z.*, 1942, 43, 170—190).—A review and discussion of modern theory of interionic forces, and of experimental data for the principal properties of electrolyte solutions. A. J. E. W.

Phase behaviour of the acetylene-ethylene system. S. W. Churchill, W. G. Collamore, and D. L. Katz (*Oil and Gas J.*, 1942, 41, No. 13, 33—34, 36—37).—This system exhibits azeotropic behaviour so that predictions of its properties from those of the pure constituents may be very unreliable. J. W.

Phase equilibria in hydrocarbon systems. Volumetric and phase behaviour of the methane-*n*-pentane system. B. H. Sage, H. H. Reamer, R. H. Olds, and W. N. Lacey (*Ind. Eng. Chem.*, 1942, 34, 1108—1116).—The sp. vols. of 6 CH_4 - n - C_5H_{12} mixtures have been determined at 100—460° F. and at pressures > 5000 lb. per sq. in. The bubble-point and dew-point pressures and the sp. vols. of the components of the coexisting phases over this temp. range are recorded. Enthalpy and fugacity data are deduced. J. W. S.

Composition of the liquid phase and of the weight-equivalent vapour phase of the systems butadiene- ψ -butylene, -ethyl alcohol, -acetaldehyde, and -ethyl ether. I. N. Buschmakina and K. I. Kutschinskaja (*Sintet. Kautschuk*, 1936, No. 5, 3—6).—Tables and graphs are given. CH. ABS. (e)

Equilibrium between the liquid and vapour of the binary system butyl alcohol-water. I. N. Buschmakina, A. P. Begetova, and K. I. Kutschinskaja (*Sintet. Kautschuk*, 1936, No. 4, 8—11).—Data are recorded for the systems $\text{BuOH}-\text{H}_2\text{O}$ and *sec.*- $\text{BuOH}-\text{H}_2\text{O}$. CH. ABS. (e)

Systems with boron trifluoride. H. S. Booth and D. R. Martin (*J. Amer. Chem. Soc.*, 1942, 64, 2198—2205).—F.p. data for systems of BF_3 with MeCl , HCl , NO , and SO_2 show that only SO_2 forms a compound, $\text{SO}_2 \cdot \text{BF}_3$, with BF_3 . The reported existence of $\text{BF}_3 \cdot 3\text{HCl}$ is refuted. W. R. A.

Binary systems composed of titanium tetrachloride and nitro-compounds.—See A., 1943, II, 4.

X-Ray methods for ternary systems. A. G. H. Andersen and E. R. Jette (*Trans. Amer. Soc. Met.*, 1936, 24, 519—540).—The methods of interpolation and extrapolation of lattice const. measurements differ from these used in binary systems. Illustrations are given from the Fe-Cr-Si diagram. CH. ABS. (e)

Fusion surface of the ternary system of organic compounds. II. C. Shinomiya and T. Asahina (*J. Chem. Soc. Japan*, 1936, 57, 732—742; cf. A., 1936, 429).—Eutectic points of binary systems of $\text{C}_6\text{H}_5\text{Mc}(\text{NO}_2)_3$ (I) and $\text{C}_6\text{H}_3(\text{NO}_2)_3$ (II) are at 59° and 59.5% (I); (II) and $\text{OMe} \cdot \text{C}_6\text{H}_2(\text{NO}_2)_3$ (III) are at 45° and 37.5% (II); (III) and (I) are at 42° and 60.0% (III). The eutectic point of a ternary system of (I), (II), and (III) is at 30°, 26.8% (I), 27.6% (II), and 45.6% (III). CH. ABS. (e)

Zirconium salts. (Mlle.) M. Falinski (*Ann. Chim.*, 1941, [xi], 17, 237—325).—By analysis of the saturated solutions and wet solids it has been shown that the following compounds exist in the system $\text{ZrO}_2-\text{SO}_3-\text{H}_2\text{O}$: $\text{Zr}(\text{SO}_4)_2$, $\text{Zr}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$, $2\text{ZrO}_2 \cdot 3\text{SO}_3 \cdot 5\text{H}_2\text{O}$, $\text{Zr}(\text{SO}_4)_2 \cdot \text{H}_2\text{SO}_4$, $\text{Zr}(\text{SO}_4)_2 \cdot \text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$, $\text{Zr}(\text{SO}_4)_2 \cdot \text{H}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$, $7\text{ZrO}_2 \cdot 3\text{SO}_3 \cdot 30\text{H}_2\text{O}$, and $2\text{ZrO}_2 \cdot \text{SO}_3 \cdot 7\text{H}_2\text{O}$. In the system $\text{ZrO}_2-\text{HNO}_3-\text{H}_2\text{O}$ the compounds $\text{Zr}(\text{NO}_3)_4 \cdot 6\text{H}_2\text{O}$, $\text{Zr}(\text{NO}_3)_4 \cdot 5\text{H}_2\text{O}$, and $\text{Zr}(\text{NO}_3)_4 \cdot 2\text{HNO}_3 \cdot 4\text{H}_2\text{O}$ have been shown to exist. The optical rotation of mannitol is increased by the presence of Zr salts, and evidence of the formation of unstable complexes in the solution has been obtained. J. W. S.

Heat of formation of calcium aluminates. W. A. Roth (*Z. Elektrochem.*, 1942, 48, 267).—Revised vals. for the heats of formation of $3\text{CaO} \cdot \text{Al}_2\text{O}_3$ and $5\text{CaO} \cdot 3\text{Al}_2\text{O}_3$ are +2.0 and +3.6 kg.-cal. respectively. C. R. H.

Heat of formation of manganese carbonate and entropy of manganese ion. A. F. Kapustinski (*J. Phys. Chem. Russ.*, 1941, 15, 220—227).—The heat of dissolution of MnCO_3 in *n*-HCl to give *n*- MnCl_2 and CO_2 gas is at 25° $-3680 \pm 3.5\%$ g.-cal. This gives for the heat of formation of MnCO_3 $-207,800 \pm 1\%$ and for the entropy of Mn^{++} in H_2O -19.1 ± 0.6 . J. J. B.

Influence of very fine grinding on the heats of wetting and of dissolution of sugar and cellulose. J. Gundermann (*Kolloid-Z.*, 1942, 99, 142—147; cf. *Z. physikal. Chem.*, 1941, B, 49, 64).—The heat of dissolution (q) of unground sucrose (I) is negative but becomes positive with increasing time of grinding of its suspension in CCl_4 in a swing mill. Grinding in a swing mill is described, up to a limiting concn., by the equation $C = C_0 e^{-kt}$, where C_0 is the initial concn. of the unground material and C its concn. after a time t . On the basis of the changes observed in q , the following effects were deduced: (a) grinding is 3 times as rapid with steel as with porcelain balls, (b) a ball mill grinds much better when charged with many small balls than with a few large balls, (c) the Bloch-Rosetti mill is inferior to a ball mill, and the latter is inferior to a swing mill. The sharp X-ray diffraction pattern of unground (I) is completely destroyed by sufficient grinding. When (I) is dry-ground, the changes described above are less definite since it agglomerates into a ball or clump and grinding is impeded. The dry-grinding of different kinds of coke gives graphs similar to those given by (I) when the heat of wetting q' is plotted against the time of grinding. The limiting vals. of q' for ground coke approach those for commercial active carbons (II), presumably because the surface area of the ground coke has approached that of (II). When celluloses (III) are ground in CCl_4 suspension until their X-ray diffraction patterns have disappeared, the ground material dried and then suspended in H_2O , a rise in temp. is observed. When the wetted material is re-dried and then remoistened, a smaller rise in temp. is obtained, the difference being due to the energy used up in the recrystallisation of the ground (III). The same results are obtained for both wood- and ramie- (III). It is concluded that q and q' can be used to characterise the progress of grinding. N. G.

Calculation of free energy, entropy, specific heat, and equilibria from spectroscopic data and the validity of the third law. H. Zeise (*Z. Elektrochem.*, 1942, 48, 425—447).—Thermodynamic data deduced from spectroscopic measurements are summarised and compared with experimental vals., with particular reference to their confirmation of the third law of thermodynamics. J. W. S.

VII.—ELECTROCHEMISTRY.

Electrical conductivity of the potassium fluoride-aluminium fluoride and potassium aluminium fluoride-alumina systems. K. Batashev and A. Shurin (*Metallurg.*, 1935, 10, No. 12, 67—73).—The electrical conductivity of the $\text{KF}-\text{AlF}_3$ system at 930—1050° decreases considerably with increasing $[\text{AlF}_3]$. That of the $\text{K}_3\text{AlF}_6-\text{Al}_2\text{O}_3$ system (960—1050°) decreases rapidly with increasing $[\text{Al}_2\text{O}_3]$. The solubility of Al_2O_3 in K_3AlF_6 is slightly $>$ in Na_3AlF_6 . $\text{K}_3\text{AlF}_6-\text{Al}_2\text{O}_3$ mixtures fuse at a lower temp. than the corresponding $\text{Na}_3\text{AlF}_6-\text{Al}_2\text{O}_3$ mixtures. CH. ABS. (e)

Present state of the problem of standardising the pH scale and the potential values of reference electrodes. F. Müller and H. Reuther (*Z. Elektrochem.*, 1942, 48, 288—297).—The development of the concept of the activity pH scale, and the various attempts to obtain accurate reference electrode vals. that are free from theoretical objections based on differing views of the activity concept, are reviewed. C. R. H.

Activity of the cadmium ion in solutions of cadmium acetate. (Mlle.) M. Quintin (*Compt. rend.*, 1941, 213, 831—833; cf. *ibid.*, 212, 855).—The e.m.f. of the cell $\text{Cd}-\text{Hg}$ (2 phases) $|\text{Cd}(\text{OAc})_2$ (c) $|\text{KCl}$ saturated $|\text{KCl}$ 0.1N $|\text{Hg}_2\text{Cl}_2-\text{Hg}$ was measured at 25° with c from 0.001 to 0.396M. The normal potential $\text{Cd}|\text{Cd}^{++}$ is -0.4009 v. O. D. S.

Contact potentials. V. Metal-electrolyte Volta effect. VI. Single potential differences. VII. Chemical and thermal effects. J. A. Chalmers (*Phil. Mag.*, 1942, [vii], 33, 594—598, 599—608, 608—613; cf. A., 1942, I, 331).—Theoretical.

V. The metal-electrolyte Volta effect is probably made up of the p.d. at the metal-electrolyte boundary + that at the electrolyte-air boundary, the latter being 0.26 v.

VI. Published work on single p.d. is discussed.

VII. Consideration of enthalpy differences gives a clear distinction between the chemical and thermal origins of contact p.d. Concn. effects are thermal rather than chemical. O. D. S.

Decomposition potentials of the systems AsBr_3 -ether and SbCl_3 -ether at various current densities. I. O. K. Kudra and G. S. Kleibs (*J. Phys. Chem. Russ.*, 1941, 15, 228—233).—When c.d. increases gradually the cathodic potential changes suddenly at the moment when black powdery deposit of As or Sb takes the place of a bright deposit; this potential is termed "second decomp. potential." It decreases when $[\text{AsBr}_3]$ or $[\text{SbCl}_3]$ increases; the "first decomp. potential" is independent of concn. Black deposits are due to discharge of complex cations. J. J. B.

Decomposition potentials of the system AlBr_3 -NaCl-EtBr at various current densities. II. O. K. Kudra and G. S. Kleibs (*J. Phys. Chem. Russ.*, 1941, 15, 234—238).— AlBr_3 -EtBr mixtures show two decomp. potentials; at the lower one bright Al, and at the higher

black Al, is deposited. The lower potential is independent of $[\text{AlBr}_3]$, and the upper one increases with $[\text{EtBr}]$. In a solution of NaCl (0.5 mol.) and AlBr_3 (0.5 mol.) in EtBr there is a third decomp. potential at which Na is deposited. J. J. B.

Elimination of liquid junction potentials. IV. Conditions of extrapolation. B. B. Owen and S. R. Brinkley, jun. (*J. Amer. Chem. Soc.*, 1942, 64, 2071—2075).—A given pair of junction solutions may lead to quite different limiting cell potentials according to the nature of the electrodes employed and the way in which the limit is approached. Typical cells are described in which the limiting potential, E_j° , of the liquid junction is zero, or neglected, or calculable. Vals. of E_j° calc. from the Henderson equation agree satisfactorily with observed vals. Extrapolations must be performed at const. ionic strength. W. R. A.

Elimination of errors due to electrode polarisation in measurements of the dielectric constants of electrolytes. T. M. Shaw (*J. Chem. Physics*, 1942, 10, 609—617).—The dielectric const. of aq. solutions of glycine in presence of electrolytes has been determined over the frequency (ν) range 10—5000 kc. per sec. and the conductivity range 0.29— 1.74×10^{-4} ohm $^{-1}$ cm. $^{-1}$. Errors due to electrode polarisation can be eliminated by the methods of Fricke and Curtis (cf. A., 1937, I, 458) or of Oncley (cf. A., 1938, I, 357). If the latter method is modified by assuming that cell capacity (C) varies linearly with $\nu^{-1.7}$ instead of with $\nu^{-1.5}$, it becomes applicable to lower ν and to higher electrolyte concns. The former method is more useful than the latter as modified since it is applicable to a greater range of ν and conductivities and can be used to eliminate polarisation effects in measurements made at a single ν . The latter method requires measurements for at least two ν , but more precise results are obtainable with it. C. R. H.

Hydrogen overvoltage at high current densities. VI. Mechanism of hydrogen overvoltage. A. Hickling and F. W. Salt (*Trans. Faraday Soc.*, 1942, 38, 474—490; cf. A., 1941, I, 418).—Theories of H overvoltage assuming discharge of H ions, and those assuming recombination of H atoms, as the rate-determining factor, are considered in relation to a wide range of experimental data, and the conclusion reached is that the latter assumption is alone consistent with most of the known facts. A theory of overvoltage is developed, in which the chief assumptions are that the discharge of H ions is rapid, that the resulting H atoms give rise to a pressure of at. H which determines the electrode potential in accordance with the Nernst equation, and that the removal of adsorbed H atoms may occur by evaporation, by catalysed combination to H_2 , and by electrochemical reduction. F. L. U.

Overvoltage. XIII. Decay of cathode potential in still and stirred solutions saturated with hydrogen or with nitrogen. A. L. Ferguson and M. B. Towns (*Trans. Electrochem. Soc.*, 1942, 82, Preprint 25, 285—299).—The rate of decay (R) of polarised potentials at a platinised Pt cathode is independent of the duration of the preceding cathodic polarisation, and increases with the c.d. used to polarise the cathode. After 10 sec. R is the same in still solutions saturated with H_2 as in those saturated with N_2 ; the initial rate in N_2 is $>$ in H_2 . Stirring the solution increases R . The stable cathode potential for any c.d. increases in the order: still (H_2) $<$ still (N_2) $<$ stirred (H_2) $<$ stirred (N_2). The data support the theory that cathode polarisation potentials are determined by the activity of at. H and of H^+ at the electrode-solution interface. C. R. H.

Dropping mercury electrode in acetic acid. II. Electrocapillary curves and the theory of maxima. G. B. Bachman and M. J. Astle (*J. Amer. Chem. Soc.*, 1942, 64, 2177—2181; cf. A., 1942, I, 300).—The electrocapillary curve for Hg in AcOH solutions of NH_4OAc shows a flat, broad top with two max. which come closer on addition of H_2O to AcOH and merge to one max. at 50 mol.-% H_2O . The effect of added salts depends on the reduction potential of the cation. Two types have been identified: class I, in which the half-wave reduction potential is more negative than the first max. (A) for AcOH solutions of NH_4OAc , includes Zn^{++} , Pb^{++} , Cd^{++} , Co^{++} , Sb^{+++} , Ni^{++} , Cr^{+++} , and Bi^{+++} ; class II, with half-wave reduction potentials more positive than A, includes Pb^{+++} , Fe^{+++} , Cu^{++} , and Hg^{++} . Class I cations can be determined polarographically in AcOH after degassing, but class II cations cannot. The max. are explained on the basis of a streaming of the electrolyte around the Hg drop. Certain ions shift the position of A to more negative potentials and cause certain reducible substances to change from class I to class II. Addition of substances of high mol. wt. and of capillary-active substances tends to decrease the heights of max. W. R. A.

Polarographic investigation of rhenium compounds. II. Oxidation of Re' at the dropping electrode and the potential of the $\text{Re}^{++}-\text{Re}'$ couple. J. J. Lingane (*J. Amer. Chem. Soc.*, 1942, 64, 2182—2190; cf. A., 1942, I, 303).—A Zn reductor is described in which reduction can be performed at a controlled temp. and in the absence of O_2 . Re' is produced when ice-cold and air-free solutions of ReO_4^- ions in dil. H_2SO_4 and HClO_4 are reduced by Zn and this has been confirmed by oxidimetric titration with $\text{Ce}(\text{SO}_4)_2$. Polarograms of solutions of Re' in 1—2N- H_2SO_4 and 1N- HClO_4 show three anodic

waves pertaining to the same oxidation states in both media. The diffusing currents in both media $\propto [\text{Re}']$. The three waves, of which the middle one is resolved into two components, represent oxidation of Re' to (i) Re'' , (ii) Re''' and Re^{IV} , (iii) Re^{VII} (i.e., ReO_4') and amperometric titration with $\text{Ce}(\text{SO}_4)_2$ confirms this. Partly oxidised solutions, with an average oxidation state of Re^{I} , are obtained by warming dil. H_2SO_4 solutions of Re' to $\sim 50^\circ$ for 1 hr. in the absence of O_2 but polarograms indicate that this is not due to presence of Re^{I} but to a mixture of Re' and oxidation states higher than Re^{I} .

W. R. A.

Reactions between metals and electrolyte solutions. V. Existence of the difference effect in metal replacement processes. R. Piontelli and G. Poli (*Z. physikal. Chem.*, 1942, A, 190, 317—330).—When a sample of Cd and an auxiliary electrode of a more inert metal (Cu or Pt) are immersed in aq. CuSO_4 a current flows in the external circuit between the electrodes and Cu is deposited on the auxiliary electrode. Stirring the solution accelerates the deposition of Cu on the Cd and decreases the current between the electrodes. This effect is attributed to an increase in the local currents at the Cd electrode, and is in accord with the theory of multi-electrode systems.

J. W. S.

Adsorption of reduced methylene-blue at the dropping mercury electrode. R. Brdička (*Z. Elektrochem.*, 1942, 48, 278—288).—The current-potential curves show that reduction takes place in two stages if pH is > 4.92 and if the methylene-blue (I) concn. is $< 6.1 \times 10^{-6}\text{M}$. The presence of the additional initial stage is ascribed to the adsorption of a reduction product, the adsorbed mols. limiting the magnitude of this stage. Equations for the current-potential curves have been derived with the aid of the Langmuir adsorption isotherm, and from them have been calc. the max. no. of mols. of reduced (I) adsorbed at 25° ($\sim 10^{14}$ mols. per cm^2) and the mol. energy of adsorption (11.2 kg.-cal. per mol.). Kinetic adsorption equations which have been derived lead to a val. of 0.0046 sec. for the average duration of adsorption of a mol. of reduced (I) on the Hg surface.

C. R. H.

VIII.—REACTIONS.

Temperature-dependence of reaction rates from the standpoint of the Brönsted-Christiansen-Scatchard equation. E. S. Amis and G. Jaffé (*J. Chem. Physics*, 1942, 10, 646—650).—The k_∞ term in the Brönsted-Christiansen-Scatchard general kinetic equation is divided into two parts, one representing the rate coeff. extrapolated to a standard reference state of temp., dielectric const. (D), and concn., the other giving temp.-dependence and embodying a non-electrostatic potential which is independent of D and has a positive val. for those distances at which the formation of an intermediate compound between the two reacting mols. occurs. If the two reactants have charges of the same sign, the ratio of rate-dependence on temp. (a_T) to rate-dependence on D (a_D) is $> T/D$; if they are of opposite sign $a_T/a_D < T/D$. Existing kinematic data are satisfactorily applied to the equations.

C. R. H.

Conditions of self-ignition of gas mixtures. XVII. Effect of composition of mixture on induction period of the cold flame of acetaldehyde. N. P. Keier and M. B. Neumann (*J. Phys. Chem. Russ.*, 1941, 15, 156—163).—At 231 — 265° the induction period τ , when $[\text{O}_2]$ is kept const., is $\tau = B/[\text{MeCHO}]^2$, and when $[\text{MeCHO}]$ is const., $\tau = C + D/[\text{O}_2]^2$; B , C , and D are functions of temp. When $[\text{MeCHO}]$ varies, C and D are inversely $\propto [\text{MeCHO}]^2$. These rules are valid for $[\text{O}_2]$ between 8 and 90 mm. Hg, and for $[\text{MeCHO}]$ between 50 and 420 mm. They are accounted for by a chain mechanism involving the branching of the chains by triple collisions of AcO_2H with MeCHO and O_2 .

J. J. B.

Heat of dissociation of cyanogen. N. C. Robertson and R. N. Pease (*J. Chem. Physics*, 1942, 10, 490).— H_2 reacts with C_2N_2 at 575 — 675° by the chain mechanism: (1) $\text{C}_2\text{N}_2 \rightarrow 2\text{CN}$, (2) $\text{CN} + \text{H}_2 \rightarrow \text{HCN} + \text{H}$, (3) $\text{H} + \text{C}_2\text{N}_2 \rightarrow \text{HCN} + \text{CN}$, (4) $\text{H} + \text{HCN} \rightarrow \text{H}_2 + \text{CN}$, (5) $2\text{CN} \rightarrow \text{C}_2\text{N}_2$. The rate of reaction agrees with a val. 120—130 kg.-cal. per mol. for the heat of dissociation (D) of C_2N_2 . The overall activation energy is ~ 72 kg.-cal.

L. J. J.

Mechanism of the thermal polymerisation of styrene. Effect on the polymerisation of methylated *p*-benzoquinone and chloranil. J. W. Breitenbach and H. L. Breitenbach (*Z. physikal. Chem.*, 1942, A, 190, 361—374).—Benzoquinone, its Me derivatives, and chloranil all decrease the rate of polymerisation of styrene at 60 — 150° and also decrease the mean chain length of the polymeride. It is suggested that the quinone reacts with the polystyrene chains in some manner which hinders their growth and the fact that it is partly reduced to the quinol supports the view that this is associated with dehydrogenation.

J. W. S.

Mechanism of additions to double bonds. XIV. Nature of the activated complex in bimolecular diene syntheses. A. Wassermann (*J.C.S.*, 1942, 612—617).—As the association of $(\text{CH}_2\text{CH})_2$ is not affected by O_2 or peroxides (Vaughan, A., 1932, 1209) and contrary to Kistiakowsky and Ransom (A., 1939, I, 614) entropy calculation from existing data is inconclusive, the intervention of free radicals is unproved. The slowest stage in the dimerisation

is considered to involve activated complexes of the same stereochemical type as the stable product mols.

F. R. G.

"Tervalent" carbon. XVII. Kinetics and energetics of radical dissociations.—See A., 1943, II, 6.

Reaction rates in ionic solutions. P. Debye (*Trans. Electrochem. Soc.*, 1942, 82, Preprint 13, 133—139).—Smoluchowski's method of evaluating the fundamental frequency factor for the rate of a reaction such as the coagulation of a colloidal suspension, by employing a purely diffusional treatment, is extended to include the electrostatic effects arising from the presence of net charges. The introduction of the concept of a diffuse ionic cloud leads to the derivation of the Brönsted-Debye primary salt effect formula. The so-called "solvent" term of the Christiansen-Scatchard equation, arising from the self-potential of the ions, is also derived, but appears as the linear approximation of an exponential expression.

C. E. H.

Kinetics of the reaction between copper and iodine in aqueous (potassium iodide) solution. I. L. L. Bircumshaw and M. H. Everdell (*J.C.S.*, 1942, 598—605).—For solutions at 20 — 35° containing 0.0025 — 0.02N-I in KI (initially 4 mol.), the rate of reaction with Cu is unimol. with respect to I, and is unaffected by Cu_2O formed at 100° or in the solution, or by the mode of prep. of the metal. The crit. increment is 6500 g.-cal. per g.-atom. 0.02N-I in KI (300 g. per l.) similarly gives a solution of Cu_2O . The reaction is presumed to proceed by passage of I through the Cu_2O film.

F. R. G.

Hydration of unsaturated compounds. XI. Acraldehyde and acrylic acid. D. Pressman and H. J. Lucas (*J. Amer. Chem. Soc.*, 1942, 64, 1953—1957; cf. A., 1942, I, 366).—The rates of the reactions, acraldehyde \rightleftharpoons hydracraldehyde and acrylic \rightleftharpoons hydracrylic acid, in aq. HClO_4 are of first order relative to the $[\text{H}_3\text{O}^+]$ (0.493 — 2N.) and concn. of org. compound. The rate coeffs. are lower when H_3O^+ replaces Na^+ , probably owing to formation of a less reactive oxonium complex by the org. compound; the concomitant decrease in equilibrium consts. is probably due to the hydrated compound being a weaker base than is the unsaturated compound. $\text{CH}_2\text{CH}\cdot\text{CHO}$ hydrates at 100° to the same extent in H_2O as in 0.5N-HClO_4 . ΔH of hydration are -5.8 and -6.6 kg.-cal. for the aldehyde and acid, respectively.

R. S. C.

Electrostatic influence of substituents on reaction rates. III. Solvent effect. F. H. Westheimer, W. A. Jones, and R. A. Lad (*J. Chem. Physics*, 1942, 10, 478—485; cf. A., 1940, I, 415).—The first and second saponification consts. of $\text{CH}_2(\text{CO}_2\text{Et})_2$ and $(\text{CH}_2\text{CH}_2\text{CO}_2\text{Et})_2$, measured in H_2O and in 80% EtOH at several vals. of ionic strength and extrapolated to infinite dilution, show that the electrostatic effect is greater in the solvent of lower ϵ .

L. J. J.

Rate of dissolution of particles of quartz and certain silicates. P. H. Kitto and H. S. Patterson (*J. Ind. Hyg.*, 1942, 24, 59—74).—The rate of dissolution at 36.9° was determined for quartz and other SiO_2 -containing minerals when suspended as particles comparable in size with the dust in the air of the Witwatersrand mines. The dissolved SiO_2 was determined colorimetrically by the formation of yellow NH_4 silicomolybdate. The rate increased with rise in pH and with increasing fineness of the dust. The initial high rate was due mainly to the "Beilby layer" and "edge" effects; the final slow rate probably represents the true rate of dissolution of the undisturbed surfaces.

E. M. K.

Structure and reactivity of cellulose. M. Ulmann (*Kolloid-Z.*, 1942, 98, 160—164).—The action of liquid HCl on cellulose (I) is discussed. It is a reaction that does not involve swelling or alteration of cryst. state. The extent to which grinding, recrystallisation of the ground product by treatment with H_2O , dissolution to form viscose, spinning, and mercerisation affect the course of the reaction between liquid HCl and (I) has been investigated. The deformation of the (I) lattice by grinding results in a considerable increase in the reaction velocity, although the shape of the reaction curve is similar to that of untreated ramie. There is a sudden increase in the rate of reaction when $\sim 58\%$ of the substance has reacted. Treatment of the ground product with H_2O at 100° gives a substance with the X-ray diagram of (I) hydrate. It reacts at almost the same rate as (I) that has not been mechanically treated, but there is a sudden increase in velocity when $\sim 40\%$ of the substance has reacted. Viscose fibres show almost the same curve as (I) hydrate, showing that grinding, followed by recrystallisation from H_2O , causes the same structural changes as the viscose process. Mercerisation produces hardly any change in reaction velocity.

A. J. M.

Inhibition of acetoxidation of aldehydes by carcinogenic and related compounds.—See A., 1943, III, 38.

Catalysts—ancient and modern. A. J. V. Underwood (*Chem. and Ind.*, 1942, 476—478).—The scope and efficiency of catalytic and microbiological processes are compared.

M. H. M. A.

"Tervalent" carbon. XX. Radicals as catalysts of autoxidation.—See A., 1943, II, 7.

Acidic and basic catalysis in urethane formation. D. S. Tarbell, R. C. Mallatt, and J. W. Wilson (*J. Amer. Chem. Soc.*, 1942, 64,

2229—2230).—Urethane formation from *o*-cresol and PhNCO, heated without solvent at 100°, is catalysed by Na₂CO₃, NaOAc, C₅H₅N, AcOH, CCl₃·CO₂H, ZnCl₂, and HCl. *p*-NO₂·C₆H₄·OH and *p*-OH·C₆H₄·CPh₃ behave similarly but 1:2:4-OH·C₆H₃(NO₂)₂, 1:2:6-OH·C₆H₂Cl(NO₂)₂, and picric acid do not form urethanes. Quant. data for urethane formation from *o*-cresol and α-C₁₀H₇·NCO indicate the following catalytic activity: NEt₃ > BF₃·Et₂O > C₅H₅N > HCl > CCl₃·CO₂H > NPhMe₂ > CH₂Cl·CO₂H > AcOH. Phenylurethanes were prepared by heating 2 or 3 g. of a *tert.* alcohol with an equiv. amount of PhNCO and 0.1 g. of NaOAc for 4—5 hr. but the reaction product was contaminated with CO(NHPh)₂ and PhNCO. The following have been prepared: *dimethylbutylcarbinol*, m.p. 62—63°; *diphenylmethylcarbinol*, m.p. 124—125°; *triethylcarbinol*, 61—61.5°; *benzylmethylethylcarbinol*, m.p. 83.5—84°; *benzyl-diethylcarbinol*, m.p. 96—96.5°. The mechanism appears to be one of general acid-base catalysis. W. R. A.

Homogeneous catalysis and solvent effects in a diene synthesis. A. Wassermann (*J.C.S.*, 1942, 623—626).—The course of the diene synthesis of cyclopentadiene-benzoquinone is represented by second velocity coeffs., $v = Ae^{-E/RT}$. The catalytic and solvent effects exhibit a linear relation between log *A* and *E* for measurements in C₆H₆ + CCl₃·CO₂H, CS₂, CCl₄, C₆H₆, *n*-C₄H₁₀, EtOH, PhCN, PhNO₂, and AcOH. This is interpreted in terms of theory of abs. reaction rates. F. R. G.

Homogeneous catalysis of diene synthesis. New type of third-order reaction. A. Wassermann (*J.C.S.*, 1942, 618—621).—Diels-Alder syntheses between cyclopentadiene (I) and benzoquinone, α-naphthaquinone (II), tetrachlorobenzoquinone, cyclopentadiene-benzoquinone, and (I) are catalysed by PhOH, CH₂Br·CO₂H, CH₂Cl·CO₂H, CCl₃·CO₂H, NMe₃, and (II) in C₆H₆, EtOH, C₆H₁₄, or paraffin, and by AcOH in the gas phase. The primary step is of the third order and the activation energy is near to zero. F. R. G.

Mechanism of the catalytic oxidation of ammonia. F. M. Vainshtein and M. V. Poljakov (*J. Phys. Chem. Russ.*, 1941, 15, 164—173).—Air containing 9.5% of NH₃ was passed through Pt wire nets, and the % *p* of the NH₃ oxidised to NO measured. One Pt net gave, e.g., *p* = 90, two identical nets in contact gave *p* = 97, but when the distance between the nets was increased to 17 mm., *p* fell to 94. This fall was larger when the temp. was farther from the optimum temp. (600°), e.g., at 500° or 700°. Obviously between the gauzes a homogeneous reaction which destroys NH₃ takes place. Its nature is unknown. J. J. B.

"Magneto-catalytic" effect in the hydrogenation of carbon dioxide and carbon monoxide on nickel. H. Spingler and O. Reinhard (*Z. physikal. Chem.*, 1942, A, 190, 331—340).—The velocity of reaction of H₂ with CO₂ and with CO on a Ni surface has been studied at 280—380°. No abrupt change in the rate of reduction of CO₂ is observed on passing through the Curie interval (350—360°) but the reduction of CO shows an abrupt increase in velocity at temp. outside this range, indicating a magneto-catalytic effect. J. W. S.

Preparation of butadiene by catalytic dehydrogenation of butylene.—See B., 1942, II, 417.

Efficiency of electrolytic separation of chlorine isotopes. H. L. Johnston and D. A. Hutchison (*J. Chem. Physics*, 1942, 10, 469—472).—The electrolytic separation factor for Cl isotopes is 1.0060 ± 0.0005 at 25—40° on Pt electrodes and 1.0068 ± 0.0014 on Acheson graphite. The effects of temp. and c.d. are insignificant. L. J. J.

Electrolytic decomposition of aqueous ammonium chloride solutions. C. B. F. Young and E. G. Lundstrom (*Trans. Electrochem. Soc.*, 1942, 81, Preprint 33, 469—477).—NH₃ and Cl₂ are formed when aq. NH₄Cl (18%) is electrolysed in presence of NaCl (7%) at 50—75° in a cylindrical cell with C anodes and an unsubmerged, cylindrical, perforated steel cathode covered with an asbestos diaphragm. Current efficiency increases with c.d. With anode and cathode c.d. 14.5 and 11 amp. per sq. dm. respectively, anode and cathode current efficiencies of 44.8% and 84.3% and energy efficiencies of 20.7% and 38.9% respectively are obtainable. Of the liberated Cl₂, 36% reacts to form side products. Increase of [NaCl] increases anode current efficiency and reduces the tendency of Cl₂ to form side products. C. R. H.

Anodic behaviour of tin in a stannate bath.—See B., 1942, I, 529.

Preparation of benzaldehyde by oxidation of toluene, using oxidising agents regenerated by electrolysis.—See B., 1942, II, 417.

Effect of intermittent light on a chain reaction with bimolecular and unimolecular chain-breaking steps. O. K. Rice (*J. Chem. Physics*, 1942, 10, 440—444).—The reaction rate is calc. as a function of illumination frequency for a photo-chain reaction with the mechanism (1) $A_2 + h\nu \rightarrow 2A$, (2) $A + B \rightarrow C + A$, (3) $2A \rightarrow$ stable products, (4) $A \rightarrow$ stable products, induced by intermittent light (e.g., with a rotating sector). The relationship may be used to calculate individual rate consts. from kinetic measurements. L. J. J.

Photochemical decomposition of carbon disulphide. P. M. Nicholes, N. L. Simmons, and H. D. Crockford (*J. Elisha Mitchell Sci. Soc.*, 1936, 52, 51—55).—CS₂ contained in a Pyrex bulb was decomposed by light from a quartz-Hg arc, to form (CS)_x, C₃S₂, and a brown solid (C₃S₂)_x. The C₃S₂ remained liquid at -20°. CH. ABS. (e)

Apparatus for investigating photo-reactions of halogens with organic substances in the liquid phase. Photo-reaction between chlorine and *n*-heptane. J. Stauff and H. J. Schumacher (*Z. Elektrochem.*, 1942, 48, 271—278).—An apparatus for following the course of photo-reactions in the liquid phase is described and its use illustrated by data for the reaction between Cl₂ and *n*-C₇H₁₆ in CCl₄ at 25°. The reaction, which is inhibited by O₂, has a quantum yield of 7×10^3 mols. per *hν* for a light intensity of 3.51×10^{16} *hν* per min. The kinetics of the reaction are discussed and a reaction scheme is suggested, viz., $Cl_2 + h\nu \rightarrow Cl + Cl$; $C_7H_{16} + Cl \rightarrow C_7H_{15} + HCl$; $C_7H_{15} + Cl_2 \rightarrow C_7H_{15}Cl + Cl$; $C_7H_{15} \rightarrow$ chain rupture. The third stage is the measured reaction. C. R. H.

Photosensitised oxidation of ethylenic double bonds. K. Meyer (*Cold Spring Harbor Symp. Quant. Biol.*, 1935, 3, 341—349).—Eosin and isochlorophyllin sensitised the photosensitised oxidation of AcCO₂H in alkaline solution; rhodamine B was slightly active and HCN inhibited it. The solvent influences the yield of peroxide. In the oxidation of oleic acid (which forms hydroxyoleic acid), some terpenes, and ergosterol in presence of chlorophyll, which is more active than eosin, no peroxides could be detected. CH. ABS. (e)

Chain photolysis of acetaldehyde in intermittent light. W. L. Haden, jun., and O. K. Rice (*J. Chem. Physics*, 1942, 10, 445—460).—For photolysis of MeCHO the chain mechanism (1) $MeCHO + h\nu \rightarrow Me + CHO$, (2) $CHO + MeCHO \rightarrow CH_4 + CO + CHO$, (3) $CHO + CH_3 \rightarrow$ stable products, (4) $CHO \rightarrow$ stable products, is suggested. Results with intermittent light at 200—300° give 2.6, 11.3, and 7.8 kg.-cal. for activation energies of (2), (3), and (4). *k*₂ and *k*₃ agree with the products of collision no. with Arrhenius factor, without postulating mol. orientation. *k*₄ agrees with statistical requirements for a wall reaction. L. J. J.

Counting of free alkyl radicals. Application to the photolysis of acetone. M. H. Feldman, J. E. Ricci, and M. Burton (*J. Chem. Physics*, 1942, 10, 618—623).—The Paneth method of determining the metal removed from mirrors by means of free radicals has been modified by using Pb mirrors and converting the collected Pb alkyl into Pb(NO₃)₂, which is determined microanalytically according to the Moskowitz method. When applied to the photolysis of COMe₂, the method shows the apparent half-lives of the radicals to be 0.011 and 0.008 sec. at 45° and 100°, respectively. C. R. H.

Photochemical activation of oxidation by complex metallic salts. A. Watanabe (*Iwata Inst. Plant Biochem.*, 1936, Publ. 2, 129—158).—The photo-oxidation of KI, pyrogallol (I), benzidine, *p*-C₆H₄(NH₂)₂, and Nadi reagent in presence of certain complex salts of Co was studied. In the oxidation of (I) a definite promoting effect of infra-red radiation was observed. The magnitude of the photoactivity of nuclei of the type Co(NH₃)₅X was influenced by the co-ordinated acid radical in the order CNS > NO₂ > CO₃ > Cl. The effect of light is explained on the assumption that the complex is rendered unstable by the absorbed light, so that attachment of the H₂O or substrate mols. readily occurs. CH. ABS. (e)

IX.—METHODS OF PREPARATION.

Principles for nomenclature of inorganic compounds. H. Remy (*Chemie*, 1942, 55, 267—272).

Reactions of the type A (solid) + B (solid) $\rightarrow AB$ (solid). IV. Progress of chemical reactions involving solids. G. F. Hüttig (*Kolloid-Z.*, 1942, 99, 262—277).—A list of papers dealing with reactions of this type and a review of progress are presented. C. R. H.

Preparation of deuterium chloride. H. C. Brown and C. Groot (*J. Amer. Chem. Soc.*, 1942, 64, 2223—2224).—DCl has been prepared in high purity by the reactions $BzCl + D_2O \rightarrow BzOD + DCl$; $BzCl + BzOD \rightarrow Bz_2O + DCl$ at "elevated temp." W. R. A.

Alkali and alkaline-earth phosphides. C. Legoux (*Ann. Chim.*, 1942, [xi], 17, 100—180).—The action of PH₃ on Li in liquid NH₃ yields the compound PH₂Li₄NH₃, which in a vac. at 0° yields the compounds PH₂Li₂NH₃ and PH₂LiNH₃. On heating in a vac. these compounds all yield the compound PHLi₂, which on further heating gives a mixture of phosphides. With liquid NH₃, PHLi₂ yields the compound PHLi₂·5NH₃, which in a vac. at 0° passes into the compounds PHLi₂·3NH₃ and PHLi₂·2NH₃. The action of PH₃ on Na or K in liquid NH₃ yields only PH₂Na and PH₂K. On heating at 70° in a vac. PH₂Na yields the compound PHNa₂, which decomposes at >100° with liberation of Na which distils off at >450°, leaving Na₂P₅. PH₂K decomposes at 175° with liberation of H₂ and K, which distils off at >320° leaving K₂P₅. No evidence of the formation of Na₃P or K₃P has been obtained. The action of PH₃ on Ca in liquid NH₃ yields the compound (PH₂)₂Ca₆NH₃, which in a

vac. at 0° yields the compound $(\text{PH}_3)_2\text{Ca} \cdot 2\text{NH}_3$. On heating in a vac. these yield the compound PHCa , which at higher temp. is decomposed with liberation of H_2 . The action of PH_3 on Sr in liquid NH_3 yields only an ill-defined mixture. J. W. S.

Reactions between sodium carbonate and ferric oxide and alumina. V. A. Mazel and S. N. Astanovitzkaja (*Legk. Met.*, 1936, 5, No. 4, 12—18).— Na_2CO_3 begins to react with Fe_2O_3 and with Al_2O_3 at 500°. The reactions are rapid at 700°. Excess of Na_2CO_3 increases the speed of reaction below 900°, but at higher temp. decreases it. In all cases, $\text{Na}_2\text{O} \cdot \text{Fe}_2\text{O}_3$ and $\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3$, respectively, are the only compounds produced. CH. ABS. (e)

Transformation and reactions before and during the formation of zinc-iron spinel from β -zinc hydroxide and γ -ferric hydroxide in presence of carbonates. I. Thermal behaviour of β -zinc hydroxide. W. Schröder [with H. Schmah] (*Z. Elektrochem.*, 1942, 48, 241—254).—Present knowledge of Zn-Fe spinel formation is reviewed. X-Ray and emanation methods applied to β -Zn(OH) $_2$ containing CO_2 show that the dissociation temp. of β -Zn(OH) $_2$ ($p_{\text{H}_2\text{O}} = 1$ atm.) is 120°, and that of ZnCO_3 ($p_{\text{CO}_2} = 1$ atm.) is 255°. ZnO has m.p. calc. 1900°; it is not volatile at temp. $> 1100^\circ$. The thermal behaviour of Zn(OH) $_2$ and other hydroxides and oxides is compared with that observed by other investigators. C. R. H.

Metaphosphates. K. Karbe and G. Jander (*Kolloid-Beih.*, 1942, 54, 1—146).—A review. F. L. U.

Extraction of vanadium salts. I. Separation of vanadium from ferrous iron. S. Uno and T. Izumo (*Bull. Waseda Appl. Chem. Soc.*, 1936, 28, 1—6).—The change of pH of VO_2SO_4 on addition of alkali was studied with the Sb electrode. $\text{VO}(\text{OH})_2$ was pptd. at pH 4—5. With FeSO_4 , hydroxide is pptd. by NaOH at pH 6—8. Pptn. of V in presence of FeSO_4 at pH 5—6 is complete in conc. solution. In dil. solution, pptn. is incomplete, owing to formation of a sol. CH. ABS. (e)

Interchange of heavy oxygen between water and certain inorganic oxy-anions. E. R. S. Winter and H. V. A. Briscoe (*J.C.S.*, 1942, 631—637; cf. A., 1940, I, 171).—Contrary to earlier work, interchange of ^{18}O occurs between H_2O and KH_2PO_4 and KHSO_4 respectively. These and the interchange between H_2O and NaHSO_4 show that the rate increases with temp. and concn. and is for $\text{Na} > \text{K}$. Addition of inert salts and free acid increases the rate. These and the interchange between H_2O and K_2CrO_4 are considered to occur through anhydride formation. F. R. G.

X.—ANALYSIS.

Volumetric solutions. Rapid and convenient preparation of exactly 0.1N-hydrochloric acid and 0.02N-sulphuric acid. E. Schulek and F. Szeghő (*Z. anal. Chem.*, 1942, 123, 252—271).—Precise directions are given for the prep. of 0.1N-HCl, 0.02N- H_2SO_4 , 0.1N- and 0.01N- AgNO_3 , - $\text{KH}(\text{IO}_3)_2$, - KBrO_3 , -NaOH, - KCN_2S , -I, and - $\text{Na}_2\text{S}_2\text{O}_3$; 0.1N- KMnO_4 , 0.2M- and 0.02M-KCN; 0.1N- $\text{K}_2\text{Cr}_2\text{O}_7$; and 0.5N-KOH in Pr°OH . A. A. E.

Application of potentiometric analysis to [photographic] developer analysis.—See B., 1942, II, 449.

Determination of iodide in presence of interfering substances. K. F. Shimizu and E. A. Kelly (*J. Amer. Pharm. Assoc.*, 1942, 31, 103—105).—Known analytical methods do not give accurate or consistent results for I $^-$ in FeI_2 preps. Satisfactory results are obtained by the method of distilling the I from the prep. (e.g., FeI_2 pills) in aq. H_3PO_4 after addition of H_2O_2 and absorbing the I in aq. KI, provided that suitable apparatus and procedure are used. F. O. H.

Colorimetric determination of small amounts of metaphosphate and pyrophosphate. Determination of iron with thiocyanate in presence of metaphosphate and pyrophosphate. H. E. Wirth (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 722—725).—The decrease in the colour of $\text{Fe}(\text{CNS})_3$ produced by $\text{P}_2\text{O}_7^{4-}$ or PO_3^{2-} is used as the basis of a method for determining 0.01—5 p.p.m. of these ions. A large excess of Al^{+++} releases Fe^{+++} from complexes with PO_3^{2-} and $\text{P}_2\text{O}_7^{4-}$, and Fe^{+++} can be accurately determined by means of CNS $^-$ in presence of relatively high $[\text{PO}_3^{2-}]$ and $[\text{P}_2\text{O}_7^{4-}]$ if $\text{Al}(\text{NO}_3)_3$ - HNO_3 reagent is used. L. S. T.

Qualitative analysis of the ammonia and ammonium sulphide groups. W. Lohrer (*Z. anal. Chem.*, 1942, 124, 1—17).—The method described by Fischer *et al.* (A., 1936, 1353) is simplified and shortened by using $(\text{CH}_3)_4\text{N}_4$ instead of aq. NH_3 for the pptn. of PO_4^{3-} , W, Al, Be, Cr, V, U, Fe, Zr, Ti, and La (Ce, Th) after adding aq. FeCl_3 . The pptn. of Be and La is completed by pptn. with conc. aq. NH_3 as described by Ardagh *et al.* (A., 1924, ii, 349). The separation of the above-mentioned elements from Zn, Ni, Co, Mn, the alkaline earths, and the alkalis is much sharper. Details of procedure are given. L. S. T.

Determination of silicon in alpac.—See B., 1942, I, 532.

Determination of silicon in commercial aluminium and its alloys.—See B., 1942, I, 532.

Determination of silicon in quartzites, silica bricks, and sands. V. Vepritzkaja (*Ogneuporui*, 1936, 4, 284—285).—To a sample fused with Na_2CO_3 and then dissolved in conc. HCl, gelatin is added, which leads to a coagulation of SiO_2 . CH. ABS. (e)

Determination of sodium by the uranyl zinc acetate method. Anon. (*Paper Trade J.*, 1942, 115, TAPPI Sect., 83—84).—Tappi tentative standard T 623 m-42 is described. H. A. H.

Determination of silver in silver cyanide plating solutions.—See B., 1942, I, 530.

Reaction for calcium. S. A. Celsi (*Anal. farm. bioquim.*, 1934, 5, 85—89).—A mixture of $\text{K}_4\text{Fe}(\text{CN})_6$ and $\text{Cu}(\text{NH}_3)_4\text{SO}_4 \cdot \text{H}_2\text{O}$ gives a sky-blue ppt. with Ca^{++} . CH. ABS. (e)

Determination [in water] of calcium in presence of magnesium by standard soap solution by rapid titration.—See B., 1942, III, 280.

Analysis of radioactive solutions. A. Becker and I. Schaper (*Z. Physik*, 1941, 118, 357—374).—Combined measurements of emanation and γ -radiation by the method described enable Ra, meso-Th, and Ra-Th to be determined in mixtures thereof. The sensitivity of the method is ≤ 0.01 mg. Ra-equiv. The effect of Th emanation is taken into account. L. J. J.

Rapid photometric determination of magnesium in aluminium alloys.—See B., 1942, I, 532.

Rapid determination of magnesium in [aluminium] alloys containing zinc.—See B., 1942, I, 532.

Determination of zinc in aluminium and its alloys.—See B., 1942, I, 532.

Alkalimetric determination of cadmium. M. M. Tillu and M. S. Telang (*J. Indian Chem. Soc., Ind. Ed.*, 1942, 5, 134).—The method is based on the treatment of $\text{Cd}(\text{OH})_2$ with excess of KI to yield KOH (2 mols.). The liberated alkali must be titrated as gradually as possible. R. J. W. R.

Volumetric determination of lead as an insoluble compound using diphenylcarbazone as indicator. R. Ripan (*Z. anal. Chem.*, 1942, 123, 244—251).—Pb can be determined by titration with aq. $\text{K}_4\text{Fe}(\text{CN})_6$, $\text{Na}_2\text{C}_2\text{O}_4$, Na_2HPO_4 , Na_2CO_3 , or Na_2WO_4 in presence of NH_4OAc , or with aq. K_2SO_4 or $\text{Na}_2\text{S}_2\text{O}_3$ in presence of EtOH, using diphenylcarbazone, which is more sensitive as an indicator than diphenylcarbazide. A. A. E.

Rapid determination of copper, manganese, and iron in aluminium alloys.—See B., 1942, I, 532.

Rapid determination of manganese, phosphorus, sulphur, and silicon in pig iron.—See B., 1942, I, 524.

Colorimetric micro-determination of iron. C. P. Sideris (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 756—758).—The green colour formed by Fe^{++} with nitroso-R-salt (I) at pH 8—10 is used as the basis of a colorimetric method for determining 0.2—50 μg . of Fe^{++} . $2\text{NH}_2\text{OH} \cdot \text{H}_2\text{SO}_4$ is a satisfactory reducing agent for Fe^{+++} . The determination is completed by means of a photo-electric colorimeter with appropriate light filters to eliminate the yellow colour of (I). The green colour formed by Fe^{++} and (I) in aq. solution is stable for > 48 hr. at room temp. Co interferes, as well as Cu and Ni to a slight extent. The sensitivity of the method equals that of the o-phenanthroline or 2:2'-dipyridyl methods. L. S. T.

Volumetric determination of iron and titanium. W. M. McNabb and H. Skolnik (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 711—713).—The Fe^{+++} and Ti^{+++} in 4N- H_2SO_4 are reduced by means of 30-mesh Zn in a funnel, collected in Fe^{III} alum solution, which is then titrated with KMnO_4 . The Fe^{+++} and Ti^{+++} in another portion are reduced and collected in 4N- H_2SO_4 , and the Ti^{+++} oxidised by drawing air through the solution after adding 50 ml. of saturated aq. HgCl_2 , and until the violet colour disappears, and then for 5 min. longer. The remaining Fe^{++} is titrated with KMnO_4 . The time factor for complete oxidation of Ti^{+++} is thus definitely controlled. Data for the air-oxidation of $\text{Ti}_2(\text{SO}_4)_3$, $\text{Ti}_2(\text{SO}_4)_3$ in presence of HgCl_2 , FeSO_4 in presence of HgCl_2 , $\text{Ti}_2(\text{SO}_4)_3$ in presence of FeSO_4 and HgCl_2 , and $\text{Ti}_2(\text{SO}_4)_3$ in presence of FeSO_4 are recorded. L. S. T.

Use of hexamminocobaltic salts (luteocobalt salts) in quantitative analysis. I. Gravimetric determination of ferricyanide. I. G. Murgulescu and C. Drăgulescu (*Z. anal. Chem.*, 1942, 123, 272—279).— $\text{Fe}(\text{CN})_6^{3-}$ can be determined ($\pm 0.5\%$) by pptn. with 0.1M- $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ as $[\text{Co}(\text{NH}_3)_6][\text{Fe}(\text{CN})_6] \cdot 0.5\text{H}_2\text{O}$ if the excess of reagent is kept within 0.01—0.03M. and the vol. of solution is > 50 c.c. A. A. E.

Oxidation of nickelous and cobaltous hydroxides by means of persulphate. L. Dede and H. Zierjacks (*Z. anal. Chem.*, 1942, 124, 25—27).—Pptn. of Ni^{++} or Co^{++} in presence of $\text{S}_2\text{O}_8^{2-}$ by means of NaOH under different conditions of temp. and $[\text{NaOH}]$, and determinations of the I liberated by dissolving the washed ppt. in H_2SO_4 in presence of KI, show that hydrated oxides of Ni^{III} or Co^{III} are formed, since the ratio metal:O varies between 2 and 3. Co catalyses the decomp. of $\text{S}_2\text{O}_8^{2-}$ more strongly than does Ni. The formation of hydrated oxides of Ni^{IV} or Co^{IV} was not observed. L. S. T.

Determination of tungsten in its minerals. A. de Larmo Cantição (*Rev. Quím. Ind.*, 1942, 11, 132—133).—The method of Jilek and Ryšánek (A., 1933, 584) is described. F. R. G.

Volumetric determination of tin, based on the formation of a dioxalatothiometastannate. H. H. Willard and T. Y. Toribara (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 716—718).—Sn^{IV} is converted into K₂Sn₂(C₂O₄)₇ by adding K₂C₂O₄ to a definite pH range. K₂Sn(C₂O₄)₃ is converted into K₂SnS(C₂O₄)₂ by adding H₂S, or preferably K₂S solution at 60°. Excess of H₂S is removed by a current of CO₂, and S in the complex is titrated with standard I. The reactions are: $K_2Sn_2(C_2O_4)_7 + 2H_2S \rightarrow 2K_2SnS(C_2O_4)_2 + 2H_2C_2O_4 + K_2C_2O_4$, and $2K_2SnS(C_2O_4)_2 + 2I_2 + 2H_2C_2O_4 + K_2C_2O_4 \rightarrow K_2Sn_2(C_2O_4)_7 + 4HI + 2S$. In some alloys, Sn must first be separated as SnO₂·nH₂O. The dioxalatothiometastannic acid formed according to Wheeler's method (B., 1939, 159) is relatively unstable, and the method too exacting to be practicable. L. S. T.

Determination of tin in secondary aluminium alloys.—See B., 1942, I, 532.

XI.—APPARATUS ETC.

Easily-constructed electric[ally-heated tube] furnace of glass for temperatures up to 600°. R. Fricke and F. R. Meyer (*Chem.-Ztg.*, 1942, 66, 53).—Apparatus is described. M. H. M. A.

Device for visual observations at low temperatures. A. Schallamach (*J. Sci. Instr.*, 1942, 19, 169).—The object, insulated by an inverted vac. vessel, is cooled by a Cu rod immersed in liquid air. Thermocouple leads from the object pass through the rod. A. A. E.

Non-fouling hydrogen liquefier. E. R. Blanchard and H. W. Bittner (*Rev. Sci. Instr.*, 1942, 13, 394—405).—The Kapitza circuit is employed for operation with commercial H₂. Solid CO₂ is used as a pre-cooling agent. A combination heat exchanger and trap for freezing out H₂O and oil vapour from large, rapid streams of compressed gas is described. A. A. E.

Analysis of the movements of shadow-edges on the refractometer in the case of biaxial gemstones. E. J. Burbage and B. W. Anderson (*Min. Mag.*, 1942, 26, 246—253).—Curves show the movements of the two shadow-edges as the stone is rotated on the refractometer, and means are given for determining the three principal indices of refraction from observations on one surface. L. J. S.

Photo-electric tristimulus colorimetry with three filters. R. S. Hunter (*U.S. Bur. Stand.*, 1942, Circ. 429, 46 pp.).—The use of a photo-electric reflectometer for measuring the colours of materials is described. It consists of a barrier-layer photo-cell used in conjunction with three selected spectral filters. Errors in photo-electric tristimulus measurements are detailed, and the standards used are discussed. Examples of the use of the method in the determination of the colours of fabrics and pigments are given. A. J. M.

Microscope and back-reflexion X-ray camera. C. Wainwright (*J. Sci. Instr.*, 1942, 19, 165—166).—A specimen table having a geometrical mounting is transferred from the microscope to the back-reflexion camera so that the same area of the specimen viewed through the microscope is covered by the X-ray beam. A. A. E.

Large two-lens quartz spectrograph of compact design. S. Jacobsohn (*J. Opt. Soc. Amer.*, 1942, 32, 164—167).—Apparatus is described. O. D. S.

Ultramicroscopic surface photography by the "replica" method. H. Mahl (*Naturwiss.*, 1942, 30, 207—217).—Electron-microscopic photographs of metallic or other surfaces are obtained by means of a replica obtained by forming a thin film of oxide or lacquer on the surface which may be freed from the surface, usually by dissolving the underlying body, but retains the surface structure. Electron-microscope photographs of such replicas for Al, Ni, and NaCl surfaces are shown, and the significance of the intensity distribution in the image is discussed. The process of dissolution of Al and some alloys in etching media and of primary crystallisation in Al-Mg and Al-Cu-Mg alloys has been followed. O. D. S.

Some characteristics of metal mirrors and a new gonireflectometer. F. Benford and W. A. Ruggles (*J. Opt. Soc. Amer.*, 1942, 32, 174—184).—The reflectivities of mirrors of Ag, Al, Au, Cu, Cd, Rh, Cr, Ni, Pt, Mo, W, brass, Al alloys, stellite, and alzak in evaporated and solid forms have been measured at angles of incidence from ~12° to 84°. Methods of calculating the average reflectance are discussed. The presence of ½—2% of Mg in Al mirrors improves the reflectance by ~3%. Changes occurring in the mirrors on keeping are discussed. Apparatus for measuring reflectivities at varying angles of incidence is described. O. D. S.

Measurement of γ-radiation in Roentgens. Low-absorption Roentgen-ray measurements for 10—250 kv.—See A., 1942, III, 932.

Portable Geiger-Müller counter. Simplified Geiger-Müller counter tube circuit.—See A., 1942, III, 951.

Compact, supervoltage Roentgen-ray generator.—See A., 1942, III, 933.

X-Ray investigation of large lattice plane distances and investigation of flowing solutions. H. Kiessig (*Kolloid-Z.*, 1942, 98, 213—221).—A special X-ray camera for the investigation of substances with considerable distances between the lattice planes, which would give Debye rings of very small diameter with the normal apparatus, is described. Cu K_α radiation is used, and an evacuated camera is necessary to avoid absorption and scattering. The camera can be used at high or low temp., and with flowing solutions. Examples of its use for solids and for the investigation of soap solutions are given. A. J. M.

Ellipsoid method of determining dielectric constants. Y. Björnsthål (*Z. Physik*, 1941, 118, 257—263).—The consequences of the theory of the ellipsoid method of determining dielectric const., ϵ (Fürth, *Z. Physik*, 1924, 22, 98), have been examined, and lead to a modified theory. The moment of inertia of an ellipsoid of a material of given ϵ and conductivity in an electric field depends on ϵ of the surrounding liquid. The effect of mechanical waves in certain liquids on the moment of inertia is examined. A. J. M.

Effect of conductivity on the determination of dipole moments. A. Parts (*Keem. Teated*, 1934, 2, 27—29).—In determining the dipole moment of a liquid with high-frequency oscillations, a correction for the conductivity of the liquid must be applied. CH. ABS. (e)

Photo-electric titrations with selenium cells. Y. Kasai and S. Takii (*Repts. Imp. Ind. Res. Inst., Osaka*, 1935, 16, No. 3, 1—12).—An apparatus using Se cells is described. Examples of its use are given. CH. ABS. (e)

Improvement in resolving power in the emission electron microscope. H. Boersch (*Z. tech. Physik*, 1942, 23, 129—130). W. R. A.

Suitability of beryllium for the production of super-microscopic impression foils. O. Rüdiger (*Naturwiss.*, 1942, 30, 279).—It is possible to investigate the texture of samples of Fe and steel surfaces by means of the electron microscope with the aid of vaporised Al films. The nuclei of the Al foil are sufficiently small to enable a satisfactory image to be obtained up to a magnification of 10,000, but above this the nuclear structure interferes. Be films avoid the disadvantages of Al; because of its lower at. no. scattering causes interference only with very thick films, and the nuclei are so fine that they do not cause distortion. Moreover, the Be film is easily dissolved in very dil. H₂SO₄. A. J. M.

20-Million electron-volt betatron or induction accelerator. D. W. Kerst (*Rev. Sci. Instr.*, 1942, 13, 387—394).—The instrument described has a pole 19 in. in diameter and weighs 3½ tons. The X-ray output is 16 r. per min. at 1 m. The orbit is expanded towards an X-ray target by an abrupt change of flux distribution in the air gap produced by auxiliary coils, the final energy of the electrons being determined by timing. A. A. E.

[Preparation of] Ross filter foils by evaporation. J. C. Clark and R. H. Esling (*Rev. Sci. Instr.*, 1942, 13, 383—386).—Powdered Sb was evaporated in vac. from a micro-analysis crucible on to Cellophane, giving a deposit 0.0015 cm. thick. It was then balanced with a rolled Sn foil. A. A. E.

Apparatus for investigating physico-chemical properties of solutions in liquefied gases and for carrying out reactions in such solutions under pressure. A. I. Schattenstein (*J. Phys. Chem. Russ.*, 1941, 15, 246—253).—25 standard parts of stainless steel are described which can be combined to make many pieces of apparatus. Special glass parts (viscosimeter, capillary rise tube, etc.) also have standard dimensions and can be fitted into the steel holders using joints of metal of low m.p. J. J. B.

Determination of surface tension with the Mohr balance. J. Tagger (*Physikal. Z.*, 1941, 42, 53—55).—A rectangular plate, suspended from the arm of a specially damped Mohr balance and suitably counterpoised, is immersed in the liquid to such a depth (d) that the surface tension pull is just counterbalanced by the upward thrust of the liquid. γ is then calc. from d . d is measured by attaching the reservoir of liquid to the sliding block of a cathetometer. The effects of impurities and the previous history of the plate on the results are briefly discussed. A. J. E. W.

Manipulation of Wollaston wire. H. E. Bennett (*J. Sci. Instr.*, 1942, 19, 168—169).—Removal of the Ag sheath from Pt wire < 1 μ. in diameter is described. The fine wire can be welded to a thicker one by electrically heating the latter at 1500°. Curves of fusing current for fine Pt wires in air and in vac. are given. A. A. E.

Capillary mercurial barometer. (Sir) C. V. Boys (*J. Sci. Instr.*, 1942, 19, 168).—The technique of making and filling the barometer is fully described. The capillary tube is drawn and blown from quill glass tubing, and requires ~¼ lb. of Hg. The instrument is robust. A. A. E.

Isothermal diffusion method of preparing highly purified micro-chemical reagents. E. Abrahamczik (*Chemie*, 1942, 55, 233—234).

—The principle of the method is to allow volatilisation to take place in an evacuated desiccator, the vapours being absorbed by pure H_2O or other solvent. Details for preparing several acid and halogen solutions, aq. NH_3 , $AcOH$, CH_2O , etc. are given. C. R. H.

Absorptiometer, polarograph, and spectrograph. H. K. Whalley (*Chem. and Ind.*, 1942, 495—497).—The limitations and advantages of the instruments are compared. All give results liable to errors of only a few % with speed and economy. A. A. E.

Mechanical manipulator for small pipettes. Precision pipette for volumetric gas analysis.—See A., 1942, III, 951.

Absorption of atmospheric oxygen [during grinding] in a [steel] ball mill.—See B., 1942, I, 490.

Particle size studies. Methods.—See B., 1942, I, 491.

XIII.—GEOCHEMISTRY.

Mineral waters of the state of Paraná. D. T. de Lacerda (*Rev. Brasil. Quím.*, 1942, 14, 150—152).—Analyses of H_2O from the wells of Lambedor and Santa Clara are recorded. F. R. G.

Presence of sulphur bacteria in the "pink" layer waters of the Surachani petroleum deposit and the geochemical importance of this factor. V. T. Malischek, A. A. Malijantz, and E. A. Reinfeld (*Azer. Neft. Choz.*, 1935, No. 7—8, 38—49).—The colour is due to purple S bacteria present up to a depth of 1600 m. The increase of $[SO_4^{--}]$ characterising both the colourless and the "pink" waters is due to the presence of S bacteria. CH. ABS. (e)

Chloride content of fluviomarine deposits. C. Francis-Bœuf (*Compt. rend.*, 1941, 213, 657—660).—The $[Cl^-]$ of estuarine sediments is correlated with their H_2O absorption for varying positions between tide-marks. The H_2O absorbed has a higher $[Cl^-]$ than the estuary H_2O . L. J. J.

Pigment in black and red sediments. P. E. Raymond (*Amer. J. Sci.*, 1942, 240, 658—669).—The dark colour of some marine muds is attributed to chitinous debris. X-Ray analysis shows that the red pigment of many soils of warm, moist regions is hæmatite (I). (I) is not the product of dehydration of limonite, but results probably from the combined actions of putrefactive and nitrifying bacteria, which produce $Fe(NO_3)_3$ and NH_3 . These react to form brown $Fe_2O_3 \cdot nH_2O$ which slowly loses H_2O and crystallises to red (I). L. S. T.

Liquefaction of the earth. A. Mercier (*Arch. Sci. phys. nat.*, 1942, [v], 24, Suppl., 82—86).—The author's polytropic model gives more probable conditions for rapid terrestrial liquefaction than does Jeffrey's radiation hypothesis. L. J. J.

Use of ammonium hypophosphite in determinative mineralogy. E. E. Wahlstrom (*Amer. Min.*, 1942, 27, 385—386; cf. A., 1941, I, 430). L. S. T.

Barium-felspars (celsian and paracelsian) from Wales. L. J. Spencer (*Min. Mag.*, 1942, 26, 231—245).—Well-cryst. material from the Benallt Mn-ore mine near Rhiw, Carnarvonshire, includes celsian (I) and paracelsian (II), both of the composition $BaAl_2Si_2O_8$ and d 3.31—3.33. Detailed analyses [(Miss) H. Bennett] show BaO 38.94%, etc. (I) is monoclinic, $a:b:c = 0.6613:1:0.5518$, β $64^\circ 51'$, with adularia habit and twinned on the Manebach, Manebach-Baveno, and Carlsbad laws. (II) is morphologically orthorhombic, $a:b:c = 0.9470:1:0.8956$, with habit and angles remarkably close to those of topaz. Optical examination of thin sections shows, however, a complex twinning structure. Rather than representing dimorphous forms, (II) is probably a complex twinned form of (I), but no crystallographic relationship could be traced between them. A review and bibliography of Ba-felspars is given. L. J. S.

Chemical data on a silica-poor argillaceous hornfels and its constituent minerals. F. H. Stewart (*Min. Mag.*, 1942, 26, 260—266).—Detailed chemical analyses are given of hornfels (SiO_2 40.77, Al_2O_3 25.90%, etc.) from Sparcraigs, Aberdeenshire, and of garnet, spinel, cordierite, and biotite separated from this rock. The distribution of FeO , MgO , and MnO is noted; practically all the MnO has been taken by the garnet. Optical data are given for these minerals, and the composition and optical data of optically positive cordierites are compared. L. J. S.

Cummingtonite and gedrite from Sutherland. R. S. Collins (*Min. Mag.*, 1942, 26, 254—259).—Detailed chemical analyses are given of two Ca-poor amphiboles separated from schists near Strathly. and the compositions are correlated with the optical data. L. J. S.

Primary limestone structures of West Virginia. P. H. Price and J. B. Lucke (*Amer. J. Sci.*, 1942, 240, 601—616).—Field and laboratory data are discussed in relation to origin. L. S. T.

Metamorphism of dolomites produced by contact with serpentines in the Divrik (Turkey) region. M. Gysin (*Arch. Sci. phys. nat.*, 1942, [v], 24, Suppl., 33—38).—The stratiform layers of dolomite,

mixtures of dolomite and serpentine, and more or less carbonated serpentine described result from intrusion of peridotites into sedimentary formations, followed by serpentinisation of the peridotites and carbonation of the serpentines in contact with dolomites. The resulting stratiform dolomite is distinguished from sedimentary dolomite by higher Mg content, residual cellular structure, and presence of grains of chromiferous magnetite. L. J. J.

Mineral and metal variations in the veins of Fresnillo, Zacatecas, Mexico. J. B. Stone and J. C. McCarthy (*Amer. Inst. Min. Met. Eng.*, 1942, *Tech. Publ.* 1500, 16 pp.).—Changes in the mineralogy and metal content of the principal veins are described and discussed. Data for variations in Ag, Cu, Pb, Au, and Zn in Cueva Santa vein are represented graphically. The mineralogy and paragenesis of the sulphide ores are described. Analyses of an unidentified mineral corresponding with the formula $Pb_{22}Ag_3Bi_3SeS_{22}$ are recorded. L. S. T.

X-Ray data on several phosphate minerals. D. McConnell (*Amer. J. Sci.*, 1942, 240, 649—657).—X-Ray diffraction patterns show that pseudowavellite (I) and dussertite (II) belong to the alunite and jarosite groups, respectively. The formula of (I) should be rewritten as $CaAl_3(PO_4)_2(OH)_5 \cdot H_2O$. (II), $BaFe_3(AsO_4)_2(OH)_5 \cdot H_2O$, is an arsenate of Fe and Ba, and not Ca. A chemical analysis [F. A. Gonyer] is given. Sarcopside is not related directly to triplite, and its diffraction pattern is different from that of wagnerite. Zepharovichite is identical with wavellite (III), coeruleolactite is merely turquoise (IV) and callinite is a mixture of (III) and (IV); hence these names should be dropped. Kopeite, evansite, richellite, borickite, and diadochite are amorphous with respect to X-rays. The so-called amorphous minerals colophane, griphite, delvauxite, and palmerite give good diffraction patterns. L. S. T.

Evidence of sulphide-silicate immiscibility at Gap Nickel Mine, Pennsylvania. L. Moyd (*Amer. Min.*, 1942, 27, 389—393).—Rounded masses of amphibole occurring in the sulphide matrix afford evidence of sulphide-silicate unmixing. L. S. T.

Thermal studies of orthoclase and microcline. J. L. Rosenholtz and D. T. Smith (*Amer. Min.*, 1942, 27, 344—349).—Thermal studies on crystallographically oriented sections of orthoclase (I) and microcline (II) for the range $0-1000^\circ$ are described. Coeffs. of linear expansion for (II) parallel to each axis are given. Eleven abrupt vol. changes occur with (I), and 20 with (II). Adularia, (I), and (II) are compared. L. S. T.

Alteration products of olivine and leucite in the leucite-lamproites from the West Kimberley area, W. Australia. R. T. Prider and W. F. Cole (*Amer. Min.*, 1942, 27, 373—384).—The leucite (I) is replaced largely by a turbid substance. X-Ray and optical data and a chemical analysis indicate that (I) has been replaced by an aggregate of orthoclase and an unidentified clay-like mineral. Olivine has been replaced by nontronite. L. S. T.

Nickel chlorite of the W. Kemper-Saï deposits. G. S. Gritzaenko (*Min. Suir.*, 1936, 11, No. 5, 41—44).—Schuchardite or Ni-clinochlore (up to 7.2% Ni) closely resembles clinocllore. Its genesis is discussed. CH. ABS. (e)

Crystallisation of pyroxenes from rock magmas, with special reference to the formation of pigeonite. H. Kuno (*Japan. J. Geol.*, 1936, 13, 141—150).—Analytical data for pyroxenes from a large no. of Japanese rocks are given. The pyroxenic components of intratelluric magmas crystallised as hypersthene and (or) augite if there was little $FeSiO_3$ (I), and as pigeonite if there was more (I). Usually the two pyroxenes were formed first, and, as the magma became enriched in (I), pigeonite started to form. CH. ABS. (e)

Petrological notes on some pyroxene-andesites from Hakone volcano, with special reference to some types with pigeonite phenocrysts. H. Kuno (*Japan. J. Geol.*, 1936, 13, 107—140). CH. ABS. (e)

Kaersutite from Dôgo, Oki Islands, Japan, and its magmatic alteration and resorption. T. Tomita (*J. Shanghai Sci. Inst.*, 1934, [II], 1, 99—136). CH. ABS. (e)

Secondary uranium minerals. R. Nováček (*Věst. Král. České Spol. Nauk.*, 1935, 2, No. 7, 36 pp.).—Microchemical analysis of johannite ($CuO \cdot 2UO_3 \cdot 7H_2O$), uranopilite ($6UO_3 \cdot SO_3 \cdot 16H_2O$), β -uranopilite ($6UO_3 \cdot SO_3 \cdot 10H_2O$), uranotile ($CaO \cdot 2UO_3 \cdot 2SiO_2 \cdot 6H_2O$), β -uranotile, and cuprosklodowskite ($CuO \cdot 2UO_3 \cdot 2SiO_2 \cdot 6H_2O$) are given. CH. ABS. (e)

Copper-bearing coal seams of Potschendorf and bituminous coal occurrences at Liebenau (Sudetenland). O. Settmacher (*Glückauf*, 1942, 78, 474—477).—Analyses are given. R. B. C.

Geology of Donetz bituminous coal basin. P. Guthörl (*Glückauf*, 1942, 78, 549—553).—Analyses of the various types of coal are given. R. B. C.

Germanium in the coals of the Donetz basin. V. A. Zilbermintz (*Min. Suir.*, 1936, 11, No. 6, 16—26).—Some coal ash and coke waste contained $>1\%$ of Ge. CH. ABS. (e)

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

FEBRUARY, 1943.

I.—SUB-ATOMICS.

Absorption phenomena in a condensed spark source. G. O. Langstroth and W. W. Brown (*Canad. J. Res.*, 1942, 20, A, 173—183).—In the emission spectra of Mg, Hg, and Sn the intensity ratios of certain line pairs are dependent on the amount of the element introduced into the source. As air currents of 1500 cm. per sec. reduce the absorption but currents of 80 cm. per sec. have practically no effect, this is attributed to partial absorption which must occur mainly within the limits of the discharge zone. The radiation involving a transition to a level in the ground term shows greater self-absorption than that associated with a higher final energy level. No appreciable errors are introduced into analytical determinations by variations in the absorption due to varying air currents of normal velocity.

J. W. S.

Lifetime of the zinc line λ 3076 Å. ($4^1S_0-4^3P_1$). H. Bruck (*Compt. rend.*, 1942, 214, 307—309).—Measurements by photographic photometry and comparison with the theoretical curve give a mean val. $3.0 \times 10^{-8} \pm 5\%$ sec.

N. M. B.

Effect of photo-electrons released in the film and the size of the photometer slit on the breadth of X-ray lines. A. Kochendörfer (*Physikal. Z.*, 1942, 43, 313—329).—The measured broadening of lines in X-ray spectrograms is determined not only by particle-size and lattice-distortion effects and the width of the X-ray slit, but also by the width of the microphotometer slit and effects due to photo-electrons excited in the film. A detailed theory of these factors is given. Test measurements with 0.325-Å. X-rays show good agreement with theory; with both slits 0.002 mm. in width the true breadth of a ~ 0.003 -mm. line can be measured to $\pm 5\%$, an accuracy sufficient to permit exact study of mosaic structure in metals.

A. J. E. W.

Selenium photo-elements. V. Effect of α -rays. A. Becker (*Z. Physik*, 1942, 118, 695—705).—Irradiation of Se photo-elements with α -rays produces no measurable electromotive effect. The photo-effect is decreased owing to the effect of the α -rays on the photo-electrically effective surface of the element. The effect is not due to alteration of the optical properties of the surface. α -Rays cause a decrease in the dark resistance of the cell. Electrical changes in the body of the semi-conductor are not responsible because intensive γ -rays produce no effect.

A. J. M.

Variation of thermionic and photo-electric emission constants of silver oxide-caesium cathodes during activation. R. Suhrmann and F. W. Dehmelt (*Z. Physik*, 1942, 118, 677—694).—A superficially oxidised Ag_2O cathode was covered with Cs by vaporisation, and activated by warming to various temp. up to 180° . It was then covered with Cs again for 14 days, and activated at 171.5° . During the two activation processes the thermionic and photo-electric emission were investigated and the consts. determined at the various activation temp. The different behaviour of the emission consts. during the two activation processes is due to differences in the nature of the cathode surface.

A. J. M.

Origin of E layer of ionosphere. R. Jouaust (*Compt. rend.*, 1942, 214, 441—442).—Photo-electric ionisation at altitudes 100—120 km. must involve metastable excited atoms, e.g., the O (1S) atoms identified in this region by the line 5577 Å., O (1S) \rightarrow O (1D), in the night-sky radiation. Ionisation of this atom requires 9.32 e.v., corresponding to λ 1323 Å., which has a sufficiently high intensity at 100 km. O (1S) is produced by three-body recombination, in the presence of an O atom, of (3P) O atoms arising from absorption of solar λ 1751 Å. by O_2 .

L. J. J.

Wandering of electrons in alkali halide crystals. N. Karabascheff (*Z. Physik*, 1942, 118, 718—726).—The current due to the wandering of electrons in KBr crystals increases linearly with time. The rate of increase \propto square of the applied potential. These observations can be explained by consideration of electron diffusion in an electric field, and quant. equations are given.

A. J. M.

Field-electron microscopical observations on tungsten points. R. Haefer (*Z. Krist.*, 1942, 104, 1—10; cf. A., 1941, I, 32).—Müller's method of obtaining the cathodic emission pattern of a W point (cf. A., 1937, I, 503; 1938, I, 301) is modified to give a pattern for the whole emitting surface. The cathode is placed at the centre of a

spherical glass bulb carrying a sputtered Pt layer as anode and the fluorescent material. The emitting areas increase in size as the grain-size and the radius of curvature and "smoothness" of the point (shown by electron photomicrograms) are increased by heating; the potential required for excitation also increases. The emission pattern represents a 5×10^4 - to 2×10^6 -fold magnification of the emitting surface (resolving power 2500—10 Å.). The (100), (110), and (211) planes show reduced emission.

A. J. E. W.

Short-lived barium and lanthanum isotopes obtained in uranium fission. O. Hahn and F. Strassmann (*Naturwiss.*, 1942, 30, 324—328).—The Ba of half-life 14 min., regarded as a primary U fission product, is also present in the active ppt. from emanating U; it is also obtained from Xe. It is, however, not a pure isotope, but a mixture of two, with half-lives 6 and 18 min. The 6-min. Ba yields La with half-life 74 ± 5 min., whereas the 18-min. Ba gives rise to La of half-life 3.5 ± 0.35 hr.

A. J. M.

Problem of isomerism in nuclear physics. S. Flügge (*Physikal. Z.*, 1941, 42, 221—254).—A review dealing with theories attempting to explain nuclear isomerism. The rotation impulse and γ -activity theories are reviewed, a large no. of experimental results on nuclear isomerism are collected, and an extensive bibliography is given.

A. J. M.

II.—MOLECULAR STRUCTURE.

Infra-red spectrum of furan. (Miss) L. W. Pickett (*J. Chem. Physics*, 1942, 10, 660—663).—Infra-red spectrum data for furan vapour, obtained over the range 500—35,000 cm^{-1} , show a considerable no. of combination and overtone frequencies not previously observed, particularly a strong band at 1580 cm^{-1} . Two bands at 584 and 624 cm^{-1} and two at 725 and 763 cm^{-1} observed at low pressures are probably resolutions of the single bands at 601 and 740 cm^{-1} respectively obtained by Manzoni-Ansidei at high pressures. Assignments of frequencies are made corresponding with those made by Lord and Miller for pyrrole (cf. A., 1942, I, 313).

C. R. H.

Infra-red spectrum of polyatomic molecules. XVI. Trideuteromethyl chloride and bromide. H. D. Noether (*J. Chem. Physics*, 1942, 10, 664—668).— CD_3Cl and CD_3Br were prepared by reducing CD_3NO_2 to $\text{CD}_3\text{NH}_2\text{HCl}$ by means of HCl and Fe filings in absence of air at 70° , and converting the amine into the Bz derivative in the usual way. After purification the latter was heated with PCl_5 or PBr_5 . Infra-red spectrum data over the range 2.8—18 μ . are recorded for both halides and a complete assignment of the fundamental frequencies is given.

C. R. H.

Near infra-red absorption spectrum of methyl iodide. R. T. Lagemann and H. H. Nielsen (*J. Chem. Physics*, 1942, 10, 668—671).—New infra-red absorption data for MeI at 3.3, 6.9, 8, and 11.3 μ . reveal additional detail in each region, and give information on the structure and convergence of the Q branches of some of the bands.

C. R. H.

[Ultra-violet] absorption spectra of organometallic compounds of tin and lead. L. Riccoboni (*Gazzetta*, 1941, 71, 696—713).—The ultra-violet absorption spectra of SnEt_4 , PbEt_4 (I), SnEt_3Cl , SnEt_2Cl_2 , and PbEt_3Cl (II) are determined in C_6H_{14} and in MeOH [(II) in MeOH and in H_2O]. The continuous absorption observed is attributed to dissociation. With (I) and (II) there is decomp. and separation of Pb. In the region studied (to ν 45000 cm^{-1}), the logarithm of the extinction coeff. increases fairly uniformly as ν increases, in general rapidly, and relatively more with Sn than Pb compounds, and more in C_6H_{14} than in MeOH. The results are discussed.

E. W. W.

Long-wave-length spectra of saturated carboxylic acids, esters, and salts. H. L. McMurry (*J. Chem. Physics*, 1942, 10, 655—660).—The electron structure and spectra of the CO_2' ion and the CO_2R radical (R = alkyl group or H) in saturated mols. are discussed. In the CO_2R radical the longest- λ absorption, which occurs at 2100 Å. and is weak, is ascribed to a transition similar to that causing the weak absorption at 2900 Å. in the ^1CO spectrum in aldehydes and ketones. The analogous weak absorption of the CO_2' ion at 1900—2000 Å. is masked by a stronger absorption as a result of a transition in which a non-bonding O electron is excited to an antibonding mol. orbital of the unsaturation type.

C. R. H.

Absorption spectra and structures of pyrethrins I and II. A. E. Gillam and T. F. West (*J.C.S.*, 1942, 671—676).—Details of prep. of pyrethrin I and II concentrates and derived semicarbazones and pyrethrolones are given. Absorption spectra data are recorded, and the following conclusions are reached: (a) in the pyrethrolone fragment of the pyrethrin mols., two separate chromophoric systems are present, each containing > one double linking; thus the postulated trienone chromophoric system is not present; (b) an $\alpha\beta$ -unsaturated ketone grouping is present in a 5-atom ring; and (c) unsaturation in the side-chain is present as a conjugated diene; the presence of a cumulated diene system is precluded by absorption spectra data.

A. T. P.

Absorption of piperitenone and related ketones in the ultra-violet.—See A., 1942, II, 416.

Absorption spectra of terpenoid compounds.—See A., 1942, II, 415.

Raman frequencies of HDO. Y. P. Rao (*Indian J. Physics*, 1942, 16, 205—209).—Raman spectra of H_2O - D_2O mixtures (1:9 and 9:1) are reported and discussed. The frequencies of HDO are 2523 and 3363 cm^{-1} .

W. R. A.

Raman effect in molybdomalic complexes. (Mlle.) M. Théodoresco (*Compt. rend.*, 1942, 214, 312—315).—For neutral NH_4 molybdomalate solution, 19 Raman frequencies and a broad band at 1570—1688 cm^{-1} , and for the acid salt, 14 frequencies and a band at 1570—1716 cm^{-1} , are reported. Results are discussed in relation to mol. structure.

N. M. B.

Proper frequencies of halogen derivatives of normal saturated aliphatic hydrocarbons. M. Parodi (*Compt. rend.*, 1942, 214, 542—544).—Mathematical. A method of evaluating the frequencies for two types of chain compound is deduced. Vals. calc. for 11 compounds are tabulated, and satisfactory agreement with experiment is shown.

N. M. B.

Raman spectra of thiazole and its derivatives. I. Thiazole. II. Mono- and di-substituted derivatives of thiazole. R. Manzoni-Ansidei and G. Travagli (*Gazzetta*, 1941, 71, 677—680, 680—685).—I. The Raman spectrum of thiazole (improved prep. from diazotised 2-aminothiazole and H_3PO_2) is very similar to that of thiophene, i.e., is of aromatic character, without evidence of an ethylenic linking. Some slight deviations are attributed to the presence of the two hetero-atoms.

II. Raman spectra of 2-chloro- (I) (Gattermann prep.), 2-methyl- (II), 2:5-dimethyl- (III), 2-amino- (IV), and 2-anilino-thiazole (V) are determined. Lines ascribed to aromatic C—H are observed with (I), (II), and (IV), but not with (III) (of which the spectrum was incompletely observed, owing to fluorescence) or (V). With (IV), three lines ascribed to aliphatic C—H are observed, suggesting the tautomerism: $CMe:CH \cdot N \cdot CMe \rightleftharpoons CMe:CH \cdot NH \cdot C:CH_2 \rightleftharpoons CH_2:C \cdot CH_2 \cdot NH \cdot C:CH_2$.

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E. W. W.

Raman effect. CXXI. Butadiene, pure and in solution. K. Bradacs and L. Kahovec (*Z. physikal. Chem.*, 1940, B, 48, 63—69).—The Raman spectrum of $(CH_2:CH)_2$ in isolation and in solution in a no. of org. solvents has been examined with normal and high dispersion, and polarisation data have been determined. The results are in agreement with a rigid *trans*-configuration.

L. J. J.

Raman effect. CXXII. Association of formamide. L. Kahovec and H. Wassmuth (*Z. physikal. Chem.*, 1940, B, 48, 70—81).—For liquid and solid $HCO \cdot NH_2$ (I), and for (I) combined with cryst. salts, Raman frequencies are allocated to chain-, CH-, and NH_2 -linkings. The association of liquid (I) is considerably more modified by crystallisation either alone or with salts than by addition of salts to its aq. solution.

L. J. J.

Molecular volume and structure. III, IV. T. W. Gibling (*J.C.S.*, 1942, 661—665, 665—666; cf. A., 1941, I, 324).—III. Corrections to be applied in calculating parachor vals. due to ring formation and interaction between unbonded substituent groups containing C, H, and O are assessed. Polarity in alkylbenzenes and aromatic ethers causes a decrease in the parachor. Parachor vals. agree with a skew configuration for benzil and with a structure for Ph_2CO_3 similar to that of the Me and Et esters.

IV. Parachors of *n*-fatty acids increase with mol. wt. in the same way as those of the alkyl esters up to C_5 . From C_5 to C_{18} the parachor increment per CH_2 is 40.85 (normal val. 39.8) owing to their being mainly in dimeric forms. Extrapolation of parachor vals. for AcOH at varying temp. to 0° K. gives 260.4 for the parachor of dimeric AcOH.

L. J. J.

Physico-chemical constants of oxygen as gas-standard. E. Moles (*Compt. rend.*, 1942, 214, 424—425).—The most accurate available vals. for the mol. vol. of O_2 and the gas const. R are 22.4137 ± 0.0001 l. and 0.082056 ± 0.00001 l.-atm. The compressibility per cm. is $1.75 \pm 0.05 \times 10^{-5}$.

L. J. J.

Dispersion of liquids and solutions. II. Dispersion of water in the visible and ultra-violet. A. Kruis and W. Geffcken (*Z. physikal. Chem.*, 1940, B, 45, 438—450; cf. A., 1943, I, 43).— n^{25} of H_2O

has been measured for 74 $\lambda\lambda$ between 6680 and 2120 Å., with accuracies, depending on λ , of 1×10^{-5} or 10^{-6} . The determination of λ by this method is suggested.

W. R. A.

Thermodynamics of a relativistic Fermi-Dirac gas. D. S. Kothari and B. N. Singh (*Proc. Roy. Soc.*, 1942, A, 180, 414—423).—Expressions for the energy, pressure, free energies, and entropy of a Fermi-Dirac ideal gas are derived taking account of the effect of relativistic mechanics. The degenerate and non-degenerate cases are considered.

G. D. P.

Thermal differences of *o*- and *p*-hydrogen. K. Schäfer (*Z. physikal. Chem.*, 1940, B, 45, 451—464).—Polemical against Cohen and Urey (A., 1939, I, 515). Differences in C_p and v.p. of *o*- and *p*- H_2 , incompletely described previously (A., 1939, I, 311), are explained by the temp.-dependence of the internal field and not by a variation of intermol. forces. This temp. effect is calc., and the difference in latent heat of vaporisation is const., in agreement with experimental data, whereas, on the theory of Cohen and Urey, it should be dependent on temp.

W. R. A.

Propagation of a thermal disturbance. B. Baule (*Z. physikal. Chem.*, 1941, B, 49, 102—106).—The propagation of a momentary burst of heat is obtained by consideration of the equation for thermal conductivity. The thermal disturbance is propagated with decreasing velocity and rapidly decreasing intensity. The time taken for the disturbance to travel a distance $r \propto r^2$.

A. J. M.

Nature of the covalent binding. T. Berlin and K. Fajans (*J. Chem. Physics*, 1942, 10, 691—692).—Calculations of binding energy, made with the same assumptions as used in Bohr's treatment of H_2 , indicate not only that binding in the covalent mols. H_2^+ , H_2 , and Li_2 is caused by Coulombic forces but that part of the potential energy is due to the temporary polarity of the mols.

C. R. H.

Elementary association and dissociation processes on crystal surfaces and equilibrium conditions for finite crystals. R. Kaishev (*Z. physikal. Chem.*, 1940, B, 48, 82—90).—The average life of a vacant lattice space on a cryst. surface at a given vapour concn. is determined, not only by the work of separation of a lattice unit, but also by its average vibration-vol., which must be the same for all faces at equilibrium.

L. J. J.

Crystal theory of metals: calculation of the elastic constants. K. Fuchs and H. W. Peng (*Proc. Roy. Soc.*, 1942, A, 180, 451—476).—Approx. equations of motion for the electrons in a cyclic lattice of a metal are set up with the help of the self-consistent field. The displacements of the ions are then considered as perturbations of the motion of the electrons. The change of potential energy of the lattice due to a deformation is calc. The vals. of the elastic consts. are in satisfactory agreement with observed vals.

G. D. P.

III—CRYSTAL STRUCTURE.

Effect of thermal vibrations on the scattering of X-rays. III. M. Born (*Proc. Roy. Soc.*, 1942, A, 180, 397—413; cf. A., 1942, I, 135, 389).—Raman's explanation of diffuse scattering is compared with the thermal theory and it is shown that the modern forms of the latter are based on quantum principles. The relation between the dynamical matrix (describing the mechanical properties of the lattice) and the scattering matrix (describing the scattering power) is investigated. The background intensity determines the dynamics of the lattice in the same way that the Laue-Bragg patterns determine the geometry of the lattice. The influence of the mutual deformation of the atoms on the background scattering is considered.

G. D. P.

Diffuse scattering of X-rays by crystals. II. Detailed calculation of the surfaces of isodiffusion for the (002), (112), (222), and (110) reflexions of sodium single crystals. H. A. Jahn (*Proc. Roy. Soc.*, 1942, A, 180, 476—483; cf. A., 1942, I, 198).—Based on the theory of previous publications, detailed calculations are made for the diffuse reflexions of Na single crystals. The results are in excellent agreement with the experiments of Lonsdale and Smith. The Faxén-Waller theory of diffuse scattering receives decisive confirmation.

G. D. P.

Structure of a metal during deformation. D. Harker (*J. Chem. Physics*, 1942, 10, 692).—X-Ray diffraction patterns of a Cu ribbon obtained during and after distortion at room temp. are indistinguishable. This is taken to indicate that $\frac{2}{3}$ of the Cu was non-cryst. and that the cryst. material was of the same particle size and state of strain 0.01 sec. or several min. after deformation, i.e., a metal recrystallises as fast as it is deformed.

C. R. H.

Structure of silver chlorate, $AgClO_3$. S. von Náräy-Szabó and J. Pócza (*Z. Krist.*, 1942, 104, 28—38).—Approx. goniometric data, verifying $c/a = 0.932$, are recorded. The class C_{4h} , assigned from morphological features, is confirmed by Laue photographs and by the absence of piezoelectric properties. Oscillation X-radiograms give a 8.486, c 7.894 Å., c/a 0.930; ρ_{obs} 4.37; 8 mols. per unit cell; space-group C_{4h}^2 — $I4/m$. Intensity data obtained with an ionisation spectrometer are recorded. The at. parameters are derived, partly

by assuming the symmetry of the ClO_2 group. The Ag atoms are of two co-ordination types [(a) 4 O at 2.47 Å.; (b) 4 O at 2.52 and 4 O at 2.55 Å.]. AgBrO_2 and AgClO_2 are isomorphous. A. J. E. W.

Structure of $\gamma\text{-Ca}_2\text{SiO}_4$ and Na_2BeF_4 . H. O'Daniel and L. Tscheischwili (*Z. Krist.*, 1942, 104, 124—141).— $\gamma\text{-Ca}_2\text{SiO}_4$ is of the $\text{Si}_2\text{-olivine}$ type, with a 5.06, b 11.28, c 6.78 Å. Na_2BeF_4 has a 4.89, b 10.90, c 6.56 Å. A hexagonal modification of Na_2BeF_4 is formed at high temp. The isomorphism of X_2SiO_4 ($\text{X} = \text{Mg, Ca, Fe}^{\text{II}}, \text{ or Mn}$) is discussed. A. J. M.

Crystal structure of rubber hydrochloride. C. W. Bunn and (Mrs.) E. V. Garner (*J.C.S.*, 1942, 654—658).—X-Ray fibre photographs of rubber hydrochloride taken with the fibre axis both perpendicular to the beam and oscillating with respect to it, using specimens oriented by extension, give a cell spacing (c) 8.95 Å. along the fibre axis, with a 5.83 Å. and b 10.38 Å. This gives a cell containing 4 $\text{-CMeCl-CH}_2\text{-}$ units, with a true density 1.255 for the single crystal. The space-group is the monoclinic (pseudo-orthorhombic) $P2_1/c$, with two chains passing through the unit cell. The chain-form involves staggered C bonds. All C—C distances are 1.54 Å. and C—Cl 1.79 Å.; C—C bond angles are all $112 \pm 4^\circ$ in the chains, but Me groups are distorted with respect to adjacent C—C bonds. The structure confirms Markovnikov addition of HCl to rubber. Successive $\text{CMeCl-CH}_2\text{-}$ groups are alternately right- and left-handed. L. J. J.

Structure of tetramethylhaematoporphyrin C. H. O'Daniel and A. Damaschke (*Z. Krist.*, 1942, 104, 114—123).—The substance has a 31.3, c 19.56 Å.; 6 mols. in elementary rhombohedral cell. Space-group C_{2h}^2 — $R\bar{3}$. As in phthalocyanine, the porphyrin ring is planar. A. J. M.

Co-ordinate sexavalency in ammines of cupric halides. G. Peyronel (*Gazzetta*, 1941, 71, 363—375).—The Debye spectra of the ammines $[\text{Cu}(\text{NH}_3)_6]\text{Br}_2$ (I) and $[\text{Cu}(\text{NH}_3)_6]\text{I}_2$ (II) are determined. These have octahedral symmetry (fluorite type) with lattice consts. a_{Br} 10.30 Å., a_{I} 10.72 Å. Optical anisotropy is slight (not seriously altering the cubic lattice) in (I), but great in $[\text{Cu}(\text{NH}_3)_6]\text{Cl}_2$ (III), which cannot be assigned cubic structure. The lattice is retained during thermal decomp. of (I), (II), and (III) down to $(\text{NH}_3)_{5.05}$, at which a lattice of low symmetry is formed, persisting down to $(\text{NH}_3)_{2.3}$. (I) prepared in liquid NH_3 shows slight lattice distortion (hysteresis), which is lost after gentle heating. Magnetic susceptibility of (I), (II), and (III) is that normal for complex salts of Cu^{++} . E. W. W.

Structures of thmringite, bavalite, and chamosite, and their place in the chlorite group.—See A., 1943, I, 44.

Structures of gallium and indium trihalides. D. P. Stevenson and V. Schomaker (*J. Amer. Chem. Soc.*, 1942, 64, 2514).—Interat. distances, recalcd. by applying the radial distribution method to Brode's data (*Ann. Physik*, 1940, 37, 344), differ from his vals. and the correction he applied is considered unsuitable. The new vals. agree with those obtained by using the usual correlation method. Further, the application of the radial distribution method supports Brode's conclusion that GaI_3 is monomeric and coplanar, but GaCl_3 , GaBr_3 , InCl_3 , InBr_3 , and InI_3 are dimeric. W. R. A.

Etching patterns on aluminium surfaces. I. H. Mahl and I. N. Stranski (*Z. physikal. Chem.*, 1942, B, 51, 319—346).—Etching of Al foils by HCl and HCl—HF mixtures in H_2O and EtOH, and by electrolysis, gives a cubic relief, sometimes concealed (e.g., in purest Al) by a pseudo-pyramidal relief. The etched surface is first covered by a stable oxide film, which is then released by placing in aq. HgCl_2 . Adhering metal is removed by dil. acid and the film is photographed in an electron microscope. The form of the relief depends on the nature of the impurities in the Al, and its formation on the reaction of Al in the media and on dissolution of reaction products. Observed results are attributed to initial formation of an oxide layer. W. R. A.

Investigation of the fine structure of macromolecular substances with the electron microscope. I. Structure of β -polyoxymethylene crystals. M. von Ardenne and D. Beischer (*Z. physikal. Chem.*, 1940, B, 45, 465—473).— β -Polyoxymethylene crystals on mechanical disintegration yield fibres of 0.04—0.07 μ . diameter varying periodically along the axis, and finer fibrils of 50—100 Å. diameter. Crystals etched with 2.5N-NaOH show a sieve-like structure, with large parallel transverse fibres, 0.36 μ . apart, and fine longitudinal fibres, 50—100 Å. in diameter. The fine fibrils have a diameter corresponding with 100 parallel-packed mols. The techniques of preparing and photographing specimens are discussed. W. R. A.

X-Ray and optical measurements on β -lactoglobulin. I. Fankuchen (*J. Amer. Chem. Soc.*, 1942, 64, 2504—2505).—Orthorhombic crystals of β -lactoglobulin are tabular. The smallest refractive index, a , lies in the main prism face perpendicular to the prism length. The other vibration directions, β and γ , are parallel to the thickness and length of the crystal. Vals. of c , a , and b are 111, 60, and 62 Å., in good agreement with Crowfoot's vals. (*Chem. Rev.*, 1941, 28, 215). W. R. A.

Metamictic state. A. Faessler (*Z. Krist.*, 1942, 104, 81—113).—A series of rare-earth minerals exists in the metamictic state, i.e., in

a vitreous, amorphous form, although preserving their external crystalline appearance. A list of known examples is given. The transformation from the metamictic to the crystalline state has been investigated in gadolinite (I) and fergusonite. It takes place rapidly at high temp. with the emission of light, but also occurs slowly at lower temp. without light emission. When investigated by the Debye-Scherrer method the very brightly glowing (I) gave no interference pattern, but after being heated it gave a crystalline pattern. The sp. heat of metamictic (I) is $0.006 >$ that of crystalline (I). The heat of transformation is $41,700 \pm 1700$ g.-cal. per g.-mol. The transformation to the metamictic state is probably brought about in nature by α -rays, and is associated with a comparatively unstable lattice, such as would be present in a substance which, like (I), shows great tendency towards isomorphism. A. J. M.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Physical constants of *N*-octyl-, -dodecyl-, and -cetyl-piperidine. F. H. Stross and R. J. Evans (*J. Amer. Chem. Soc.*, 1942, 64, 2511).—Vals. are given for b.p., ρ_4^{20} , n_D^{20} , and pK_H^{27} . W. R. A.

Heat capacity of organic vapours. IV. Benzene, fluorobenzene, toluene, cyclohexane, methylcyclohexane, and cyclohexene. J. B. Montgomery and T. De Vries (*J. Amer. Chem. Soc.*, 1942, 64, 2375—2377).—Vals. of C_p at 1 atm. and from their b.p. to 410°K . have been measured for vapours of C_6H_6 , PhF , PhMe , cyclohexane, methylcyclohexane, and cyclohexene and are compared with semi-empirically calc. vals. W. R. A.

Heat capacity of hexadeuterobenzene. W. T. Ziegler and D. H. Andrews (*J. Amer. Chem. Soc.*, 1942, 64, 2482—2485).—Vals. of C_p for C_6D_6 have been determined from 101.9° to 322.6°K . with an accuracy of $\sim 2\%$ and are compared with semi-theoretically calc. vals. The agreement indicates that the low ν of C_6D_6 are correctly assigned. It is suggested that some of the medium-valued ν have been assigned too low vals. W. R. A.

Empirical heat-capacity equations of gases. H. M. Spencer and G. N. Flannagan (*J. Amer. Chem. Soc.*, 1942, 64, 2511—2513).—Consts. of empirical equations of the form $C_p^\circ = a + bT + cT^2$ have been evaluated from spectroscopic and thermochemical data on some 60 polyat. (including some triat.) mols. W. R. A.

Molar heat, heats of transition, fusion, and vaporisation, moment of inertia, and entropy of monogermane, GeH_4 . K. Clusius and G. Faber (*Z. physikal. Chem.*, 1942, B, 51, 352—370).— GeH_4 has three solid phases, and the C_p — T curve shows anomalies at 62.9° , 73.2° , and 76.5°K , the two latter representing transitions. Phase III exists from 0° to 73°K , phase II from 73° to $\sim 76.5^\circ \text{K}$, and phase I from $\sim 76.5^\circ$ to 107.26°K (m.p.). B.p. 184.80°K ; heats of transition: III \rightarrow II 130.7; II \rightarrow I 129.6 g.-cal. per mol.; heats of fusion and vaporisation are 199.7 and 3361 g.-cal. per mol. Optically phase I has a more symmetrical lattice than II or III. Moment of inertia is 8.3×10^{-40} g.-cm.² Entropy at 184.80°K is 46.56 ± 0.20 g.-cal. per degree per mol. from thermochemical data, in good agreement with the val. 46.60 derived statistically. W. R. A.

Equilibrium and nucleus formation in melting and freezing. U. Dehlinger (*Physikal. Z.*, 1941, 42, 197—203).—The range of accuracy of the Lennard-Jones theory of melting is discussed. Theory and experiment indicate that it requires modification in the case of metals. A differential equation for the formation of nuclei in a supercooled melt is obtained. It agrees qualitatively with experiment on the effect of temp. Another equation holds for crystal growth. A. J. M.

Definition of mol. wt., the mol, and Loschmidt's number. W. H. Westphal (*Physikal. Z.*, 1942, 43, 329—331).—Pohl's interpretation of mol. wt. as a dimensionless no. (cf. A., 1942, I, 318) is questioned, mol. wt. being regarded as the true mass of one mol. On this basis Loschmidt's no. remains dimensionless, but certain units applied to mol. quantities must be revised. A. J. E. W.

Specific gravity of deuterium oxide at different temperatures. K. Wirtz (*Naturwiss.*, 1942, 30, 330—332).—The ratio of the sp. gr. of D_2O at different temp. has been determined, based on the val. of d_{20}^{20} obtained by Tronstad *et al.* (A., 1938, I, 364). From the d of D_2O and ordinary H_2O it is calc. that $\text{D}_2\text{O} : \text{H}_2\text{O} = 1 : 5960$. A. J. M.

Vapour pressures of indene, styrene, and dicyclopentadiene. P. E. Burchfield (*J. Amer. Chem. Soc.*, 1942, 64, 2501).—V.p. data for indene (56.2 — 181.8°), styrene (33.5 — 116.3°), and dicyclopentadiene (I) (40.1 — 90.8°) are given. At 100° (I) is noticeably depolymerised. W. R. A.

Premelting anomalies of some long-chain normal paraffin hydrocarbons. A. Van Hook and L. Silver (*J. Chem. Physics*, 1942, 10, 686—690).—The coeffs. of thermal expansion of $\text{C}_{14}\text{H}_{30}$, $\text{C}_{16}\text{H}_{34}$, $\text{C}_{18}\text{H}_{38}$, and $\text{C}_{24}\text{H}_{50}$, determined over a wide range below and above the m.p., show increases above the standard vals. in the immediate neighbourhood of the m.p. This suggests an order-disorder mechan-

ism for the solid-liquid transition which may be more effective on the liquid than on the solid side of the m.p. Small amounts (<2%) of likely impurities have little effect on expansion, but large amounts lead to lower m.p. of the solid and to an increased slope of the expansion curve of the liquid. C. R. H.

Nomograph for calculating reduced temperatures. D. S. Davis (*Ind. Eng. Chem.*, 1942, **34**, 1174).—The nomograph includes crit. and other temp. for gases and vapours ranging from H_2 to C_6H_{18} . D. F. R.

Surface tension-viscosity nomograph for organic liquids. D. S. Davis (*Ind. Eng. Chem.*, 1942, **34**, 1231).—The nomograph is constructed from Buehler's equation (A., 1939, I, 63) and data for 32 org. liquids. D. F. R.

Surface determinations and diffusion measurements by means of radioactive inert gases. Technique and quantitative applications of the emanation method. I. Practical. II. Evaluation of results. K. E. Zimens (*Z. physikal. Chem.*, 1942, **A**, **191**, 1—53, 95—128).—I. A comprehensive review of methods using the radioactive inert gases as indicators is given. The production of the radioactive prep. and the estimation of its emanation capacity are discussed. The variation of emanation capacity with temp. is considered, and work with artificial radioactive inert gases is described. A comprehensive bibliography is given.

II. Conclusions that can be drawn from emanation curves are considered. The investigation of processes occurring within solids by the determination of changes in emanation capacity is described. The determination of surface sizes and diffusion consts. of inert gases by analysis of emanation curves is discussed. A. J. M.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Activity of highly diluted ("potenziertes") substances. K. F. Luft (*Naturwiss.*, 1942, **33**, 505—506).—The effects reported by Heintz (A., 1942, I, 393) could not be confirmed with aq. $NaNO_3$ or with $AcOH$ in C_6H_6 . F. L. U.

Rate of dissolution of crystals.—See B., 1943, I, 3.

Potentiometric determination of solubility product of manganese hydroxide. R. Näsänen (*Z. physikal. Chem.*, 1942, **A**, **191**, 54—64).—The solubility product of $Mn(OH)_2$ in $NaCl$ and KCl solutions has been determined potentiometrically. The thermodynamic solubility product is 1.89×10^{-13} . The titration curve for $MnCl_2$ and alkali hydroxide does not correspond with theory if there is excess of $MnCl_2$, owing to the formation of basic chlorides, but a reproducible curve can be obtained if the $MnCl_2$ is added to the alkali hydroxide. The effect of addition of alkali carbonate on the titration curves can be explained by the attraction of HCO_3^- and $MnHCO_3^+$ ions. The dissociation const. of $MnHCO_3^+$ is 3×10^{-4} . A. J. M.

Adsorption of water vapour by cellulose. J. D. Babbitt (*Canad. J. Res.*, 1942, **20**, **A**, 143—172).—The form of the adsorption isotherm for H_2O on wood is discussed. The Langmuir isotherm fits this curve for R.H. 0—20%, whilst Brunauer, Emmett, and Teller's relation (A., 1938, I, 190) covering multimol. adsorbed films is in accord with observation at R.H. $\geq 70\%$, above which range capillary condensation probably occurs. It is pointed out that the latter relation would also apply to unimol. adsorption if a repulsion exists between adsorbed mols. The adsorption on cotton is similar to that on wood but the internal surface area is less. The heats of adsorption—R.H. curves for various forms of wood and cotton are also derived and are shown to be almost coincident. The relationship between the heats of adsorption and of condensation is developed and there is shown to be an excess of internal energy in the adsorbed state over that in the liquid state. The reduction in total vol. when H_2O vapour is adsorbed on cellulose is attributed to the attachment of the H_2O mols. by two H-bonds. J. W. S.

Adsorption of indicator dyes on micelles of paraffin chain salts. J. Stauff (*Z. physikal. Chem.*, 1942, **A**, **191**, 69—94).—Some indicator dyes show colour changes on addition to aq. colloidal solutions of soaps, but electrometric investigations show no change in pH. The colour change is due to adsorption of the dye mols. on the micelles of the soaps. The adsorption, and therefore the colour change, are dependent on $[H^+]$ and $[OH^-]$ on the micelle surfaces, and the dissociation const. of the indicator. The equilibrium between adsorbed indicator mols. and H^+ and OH^- is satisfactorily governed by the law of mass action. A. J. M.

Surface tension of micelle-forming solutions. A. E. Alexander (*J. Chem. Physics*, 1942, **10**, 691).—The author criticises Cassel's statement (cf. A., 1942, I, 264) that a cryst. or liquid-cryst. structure can be assigned to adsorbed surface films, and suggests that a superposition of surface tension (σ) and surface stress is responsible for time effects before the min. σ is reached. C. R. H.

Resemblance between surface films on solids and on water. S. J. Gregg (*J.C.S.*, 1942, 696—708).— $FA-FS$ curves (F = surface pressure of adsorbed film, A = area occupied per adsorbed mol., S =

"sp. surface" of adsorbent), which have been drawn from published isotherms of gases adsorbed on solids, show a close resemblance to those for surface films on H_2O . Four film states have been considered, viz., gaseous, liquid-expanded and -condensed, and a transition state intermediate between the last two. From the linear portions of a liquid-condensed branch the no. of mols. adsorbable in a completed monolayer (α_0) can be calc. α_0 for a given gas and adsorbent is nearly independent of temp., theory predicting only a very slight increase with rise of temp. The formation of an adsorbed layer >1 mol. in thickness on non-porous adsorbents is marked by a fall in the $FA-FS$ curve which is connected with a reduction in the differential heat of adsorption. In the case of porous adsorbents the curves show that the adsorbed layer is unimol. throughout the region covered by a hysteresis loop, and that hysteresis originates in the transformation of the liquid-expanded to the liquid-condensed state occurring within the monolayer. C. R. H.

Physico-chemical metastases. W. Ostwald (*Kolloid-Z.*, 1942, **100**, 2—57).—The claim of the study of colloid science to an independent status is argued on various grounds, in particular because this study cannot be conveniently accommodated within the framework of classical physical chemistry, which is predominantly concerned with systems in equilibrium. Colloid systems are mostly not in equilibrium, nor do they often consist of phases in the classical sense. Retaining the term "phase" for systems in equilibrium, the author proposes the adoption of "stase" (cf. Friedel, A., 1931, 898) to denote a state of aggregation, formation, or orientation, and "metastase" to denote an intermediate condition (e.g., protoplasm or a jelly). A classification on this basis is outlined. F. L. U.

Effect of grinding on properties of high polymerides (cellulose and polystyrene) and the nature of its action.—See B., 1943, II, 9.

Chain-length differences between celluloses and cellulose nitrates.—See B., 1943, II, 9.

Soluble and insoluble forms of gelatin.—See B., 1943, II, 33.

Molecular kinetic and electrophoretic studies on carbonic anhydrase. M. L. Petermann and N. V. Hakala (*J. Biol. Chem.*, 1942, **145**, 701—705).—Carbonic anhydrase (I) has a sedimentation const. of 2.8S, a diffusion const. of 9×10^{-7} sq. cm. per sec., and a mol. wt. of 30,000. The electrophoretic mobility of the enzyme is determined over the pH range 5—9 at const. ionic strength. Its isoelectric point is at pH 5.3. Both amorphous and cryst. preps. of (I), with activities of 9000 or more units per mg. of solids, contain $\sim 15\%$ of impurity. A. T. P.

VI.—KINETIC THEORY. THERMODYNAMICS.

Existence and basicity of ammonium hydroxide. G. Briegleb (*Naturwiss.*, 1942, **33**, 506—508).—It is inferred on thermochemical and spectroscopic evidence that if NH_4OH is considered as a base in aq. NH_3 , it must be a strong base. It is better, however, to adopt Brönsted's point of view and regard NH_4^+ as a weak acid. It is probable that NH_3 in H_2O exists only as a hydrate, and not even partly as NH_4OH . F. L. U.

New method of graphical representation. Diagrams for binary mixtures involving only straight lines and circles.—See B., 1943, I, 3.

Changes in the partial pressures of binary systems with temperature. K. Fredenhagen and E. Tramitz (*Z. Elektrochem.*, 1942, **48**, 353—361).—When no chemical reaction occurs between the phases, the $\log p-1/T$ curve (p = partial pressure) for one component of a binary mixture is parallel to the corresponding curve for the pure component, since the vol. concn. is almost independent of temp. When reaction occurs between the components or intermol. forces are set up between the mols., however, the effective concn. is modified and may vary considerably with temp., thereby giving rise to an anomalous $\log p$ curve. J. W. S.

Phase equilibria in hydrocarbon systems. Composition of the dew-point gas of the methane-water system. R. H. Olds, B. H. Sage, and W. N. Lacey (*Ind. Eng. Chem.*, 1942, **34**, 1223—1227).—The composition was determined experimentally from 100° to 460° F. and up to 10^4 lb. per sq. in. The results agree within 4% with Laulhere and Briscoe's vals. for the system natural gas— H_2O . The amount of H_2O in the gas phase at the higher pressures and lower temp. is ~ 5 times that expected from simple v.p. considerations. Within the temp. range investigated the crit. pressures for the CH_4-H_2O system appear to be $\geq 10^4$ lb. per sq. in. D. F. R.

Vapour-liquid equilibrium of methanol-ethanol-water. Mechanism of ethanol dehydration. J. Griswold and J. A. Dinwiddie (*Ind. Eng. Chem.*, 1942, **34**, 1188—1191).—Equilibrium data are given. The system has no ternary azeotrope. The dehydration of EtOH by the addition of C_6H_6 , Et_2O , or C_2HCl_3 , followed by an aq. azeotropic distillation, is discussed. Another possible method consists of adding an agent to destroy the EtOH— H_2O azeotrope and to separate the EtOH as an overhead binary mixture. MeOH is unsuitable for this purpose. D. F. R.

Affinity and heat changes accompanying mixed crystal formation in the system chromium-nickel. G. Grube and M. Flad (*Z. Elektrochem.*, 1942, **48**, 377—389).—The dissociation pressure of Cr_2O_3 in contact with Cr has been determined at 780—1300° and from the results the mean heat of formation of Cr_2O_3 in that temp. range is calc. as 265.6 kg.-cal. per g.-mol. The sp. heat of Cr_2O_3 between 1000° and room temp. has also been measured and by combining the results with sp. heat data for Cr and O_2 the heat of formation of Cr_2O_3 at room temp. is calc. as 269.1 kg.-cal. per g.-mol. The dissociation pressure of Cr_2O_3 in equilibrium with Cr-Ni mixed crystals has also been studied at 1100° and 1200°, and the free energy changes associated with the formation of the alloy are deduced. The results confirm the observation that the reduction of oxides of reactive metals is facilitated by the presence of a less active metal with which mixed crystals can be formed. J. W. S.

VII.—ELECTROCHEMISTRY.

Electrical resistance of manganese-copper alloys.—See B., 1943, I, 37.

The system aluminium chloride in liquid sulphur dioxide. I. Electrolytic conductivity. U. Tesei (*Gazzetta*, 1941, **71**, 351—363).—The molar conductivity Λ of AlCl_3 in liquid SO_2 at low concns. falls, and at high concns. rises, as temp. increases, from -10° to 40° ; at intermediate concns., Λ rises to a max. and then falls with increasing temp. E. W. W.

Automatic adjustment of solute concentration in the "moving-boundary" method for the determination of transport numbers. R. Wright (*J.C.S.*, 1942, 678—680).—The change in concn. of electrolytes ($0.5\text{N-HCl} + 0.5-0.125\text{N-NaCl}$, $-\text{KCl}$, or $-\text{LiCl}$) has been determined by direct analysis of solutions withdrawn from different parts of the transport apparatus. For NaCl-HCl transference there is a fall in $[\text{NaCl}]$ at the boundary in the case of 0.5N-NaCl . With 0.25N-NaCl $[\text{NaCl}]$ at the boundary remains const., and with 0.125N-NaCl it increases. For KCl and LiCl the salt concns. of the unchanging solutions are 0.3N . and 0.2N ., respectively. Application of these concns. to the relation $T_a/T_b = C_a/C_b$ (T = transport no., C = cation concn. at the boundary, and a and b refer to leading and indicator cation respectively) results in fair agreement. C. R. H.

Is there a film theory of passivity? R. Weiner and F. Halla (*Z. Elektrochem.*, 1942, **48**, 361—377).—Some of the assumptions made in Müller's theory of passivity are shown to be invalid, whilst the quant. inferences arising from the theory are not in accord with observation. It is suggested that the passification is the primary and the coating with a film of salt a secondary process. J. W. S.

Polarography of naphthaquinone derivatives. C. Sartori and C. Cattaneo (*Gazzetta*, 1941, **71**, 713—722).—The method of Brdička (*Z. Elektrochem.*, 1941, **47**, 314) for the polarographic study of reduction of org. substances ($\text{M} \rightleftharpoons \text{M}' \rightleftharpoons \text{MH}_2$) through an intermediate semiquinonoid phase (M'), with or without reversible dimerisation (to M_2'') is applied to 3-hydroxy-2-methyl- (I) ("phthiocol"; cf. Anderson *et al.*, A., 1934, 77), 2-hydroxy-, 2-methyl-, 2-ethyl-, and 2:3-dimethyl-1:4-naphthaquinone, and to 4-hydroxy-1:2-naphthaquinone. Reduction of (I) is approx. of second order up to pH 10.4, semiquinone and dimeride being produced, the former in greater proportion at greater pH, and of first order from pH 10.4 to 13.08, semiquinone only being obtained. With the other compounds, results are similar: introduction of substituents into the naphthaquinone nucleus displaces the depolarisation potential towards the more negative, in the following order: $\text{Me} < \text{Et} < \text{Me}_2 < \text{OH} < (\text{OH})\text{Me}$. E. W. W.

Oxidation-reduction potentials measured with the dropping mercury electrode. IV. Polarographic study of α -hydroxyphenazine. O. H. Müller (*J. Biol. Chem.*, 1942, **145**, 425—441).— α -Hydroxyphenazine (I) can exist as a tautomeride the half-wave potential of which is more positive than that of the normal form. The tautomeride does not form a semiquinone over the pH range 1—13 and is not altered by the presence of small quantities of EtOH . It is the only form in which (I) exists below a concn. of 10^{-4}M . and never exceeds this concn., but diminishes slightly with increasing concn. of (I). The polarographic wave of this tautomeride decreases with increase in the drop time of the electrode so that its presence will not be indicated by a stationary electrode. Below a concn. of 10^{-4}M ., the potentiometric and polarographic methods show divergent results, but above 10^{-4}M . the effect of the tautomeride becomes negligible. J. E. P.

VIII.—REACTIONS.

Condition of freshly burnt gases. (A) W. T. David. (B) A. G. Gaydon (*Nature*, 1942, **150**, 636; cf. A., 1942, I, 400).—Polemical. A. A. E.

Upper ignition limits of sulphur in oxygen and in mixtures of oxygen and inert gases. B. M. Gugel (*J. Phys. Chem. Russ.*, 1941, **15**, 31—39).—If P_1 is the pressure of O_2 , the lowest pressure P_2 of

S which at 180—206° produces a flame is given by $P_1 = 1.11 \times 10^4 P_2^{0.587}$ mm. Hg. If n mols. of N_2 , CO_2 , or H_2O are present for 1 mol. of O_2 , P_1 is reduced by the factor $(1 + kn)^{0.5}$, where $k = 68.5/M^{0.5}$, M being the mol. wt. of the addendum. The exponent at P_2 is different from the theoretical val. 0.5 probably because of the presence of SO_2 in the gas mixture before ignition. Lachs and Piekielny's results (cf. A., 1938, I, 146) are not confirmed. J. J. B.

Kinetics of autoxidation of inorganic reducing agents. I. Titanous chloride. H. A. E. Mackenzie and F. C. Tompkins (*Trans. Faraday Soc.*, 1942, **38**, 465—473).—The rate of oxidation of aq. TiCl_3 by O_2 is given by $k[\text{TiCl}_3][\text{O}_2]/[\text{HCl}] + k'[\text{TiCl}_3]^2[\text{O}_2]$. The rate is largely controlled by hydrolysis and complex formation. A mechanism is suggested. F. L. U.

Energy-level treatment of reaction data. J. W. Baker (*Nature*, 1942, **150**, 551).—By the use of Audsley and Goss' vals. for the primary, induced, and mesomeric dipole moments of halogenobenzenes (A., 1942, I, 353) relative energy-levels in the reaction $p\text{-X-C}_6\text{H}_4\text{-CH}_2\text{Br} + \text{C}_5\text{H}_5\text{N} \rightarrow \text{X-C}_6\text{H}_4\text{-CH}_2\text{-N}^+\text{C}_5\text{H}_5\text{Br}^-$ have been calc. The vals. predict the same order for the velocities as that previously indicated in agreement with the experimental sequence. A. A. E.

Kinetics of the oxidation by permanganate by side-chains to the benzene nucleus. I. Oxidation of monochlorotoluenes. G. Speroni and R. Barchielli (*Gazzetta*, 1941, **71**, 765—773).— KMnO_4 , which in presence of H_2SO_4 oxidises chlorotoluenes to CO_2 , in AcOH yields only chlorotoluic acids. The velocities of the (second-order) reactions at 30.2° and 40.2° do not differ greatly as between isomerides; in oxidisability $p > o > m$. Heats of activation are: o , 14,300; m , 12,600; p , 14,100 g.-cal. E. W. W.

Kinetics of oxidation of aldehydes by chromic acid. III. Oxidation of tolualdehydes. IV. Oxidation of bromobenzaldehydes. E. Lucchi (*Gazzetta*, 1941, **71**, 729—736, 752—761; cf. *Boll. Scient. Fac. Chim. Ind. Bologna*, 1940, **1**, 208, 333).—III. The velocity of oxidation of o -, m - (I), and p - $\text{C}_6\text{H}_4\text{Me-CHO}$ in $\text{K}_2\text{CrO}_4\text{-H}_2\text{SO}_4\text{-AcOH}$ is determined at 20° , 30° , 40° , and 50° . In comparison with PhCHO , substitution of Me reduces oxidation velocity, which is greatest in (I). Respective heats of activation are: 12,550, 13,200, 13,050 g.-cal.; activity consts. 2.2 , 7.2 , and 5.6×10^8 (time in min.).

II. In velocity of oxidation by $\text{K}_2\text{Cr}_2\text{O}_7\text{-H}_2\text{SO}_4\text{-AcOH}$ at 20° , 30° , 40° , and 50° , m - greatly $> p$ - $> o$ - $\text{C}_6\text{H}_4\text{Br-CHO}$; at 20° the last $> \text{PhCHO}$, at 50° slightly $< \text{PhCHO}$. Heats of activation are: o , 12,150; m , 12,200; p , 13,200 g.-cal.; activity consts. 1.7 , 4.8 , 14.3×10^8 (time in min.). E. W. W.

Halogenation of phenolic ethers and anilides. XIII. Arrhenius activation energies for di- and poly-substituted aromatic ethers. B. Jones (*J.C.S.*, 1942, 676—678; cf. A., 1941, II, 287).—The kinetic study of the nuclear chlorination of aromatic ethers at $15-35^\circ$ is extended to di- and poly-substituted ethers containing activating as well as deactivating substituents. The P term of the expression $k = PZe^{-E/RT}$ is const. within limits of experimental error, whilst E varies from 9900 to 14,350 g.-cal. Results confirm views stated previously. Velocity coeffs. for chlorination in 99% AcOH of $2:4:1\text{-C}_6\text{H}_3\text{Cl}_2\text{-OR}$ ($\text{R} = \text{Me}$, Et , Pr , Pr^β), $4:2:1\text{-C}_6\text{H}_3\text{BrMe-OR}$ ($\text{R} = \text{Me}$, CH_2Ph), 2-chloro-4-tert-butylphenyl p -nitrobenzyl ether, m.p. 90° , and $2:4:3:5:1\text{-C}_6\text{HCl}_2\text{Me}_2\text{-OR}$ ($\text{R} = \text{Me}$, CH_2Ph , $\text{CH}_2\text{-C}_6\text{H}_4\text{Cl-}p$ or $-m$, $\text{CH}_2\text{-CO}_2\text{H}$), are recorded. 2:4-Dichloro-3:5-dimethylphenoxycetic acid has m.p. 146° . A. T. P.

Kinetics and mechanism of the conversion of crotyl and methylvinylcarbinyl chlorides into acetates and ethyl ethers.—See A., 1943, II, 21.

Exchange experiments with radioactive tracers. S. Ruben, M. D. Kamen, M. B. Allen, and P. Nahinsky (*J. Amer. Chem. Soc.*, 1942, **64**, 2297—2298).—Using radioactive tracers exchange occurred at a slow but measurable rate for Fe^{2+} and Fe^{2+} o -phenanthroline, Fe^{2+} and Fe^{2+} 2:2'-dipyridyl, and Mg^{2+} and Mg 8-hydroxyquinoline salt. No exchange occurred between Fe^{2+} and ferrihæme, ferrihæmoglobin, Fe^{3+} phæophytin, or Fe^{3+} tetraphenylporphyrin, or between Cu^{2+} and Cu^{2+} phæophytin. Structural factors appear to be more important than bond character in determining the readiness of the metallic ion in an organo-metallic compound to undergo exchange. W. R. A.

Absorption of oxygen by glutathione in alkaline solutions. I. Kinetics of the reaction at pH 9—11. M. B. Young and H. A. Young (*J. Amer. Chem. Soc.*, 1942, **64**, 2282—2287; cf. A., 1941, II, 283).—The rate of absorption of O_2 by glutathione (I), catalysed by CuSO_4 , in the pH range 9—11 has been measured under varying conditions of pressure of O_2 , $[\text{OH}^-]$, $[\text{Cu}^{2+}]$, and concn. of (I). (I) is the reactive species. The autocatalytic reaction is independent of concn. of (I) but depends on $[\text{Cu}^{2+}]$. A rate law and partial mechanism are proposed. W. R. A.

Hydrogen exchange of aromatic amines with D_2O and T_2O . B. J. Fontana (*J. Amer. Chem. Soc.*, 1942, **64**, 2503—2504).—Quant. exchange data for D_2O and T_2O with crystal-violet (I), methylene-blue (II), Me-orange, Congo-red, benzidine, and benzidine-HCl (1:1 and 1:2) mixtures are recorded. Vals. of partition ratios (h) for

(I) and (II) have been corr. for zero D content and the average val. is 1.04. Vals. of k for T and D and for T and H are 1.2 and 2.0. W. R. A.

Kinetics and equilibria of the carbinol formation of phenolphthalein. (Miss) M. D. Barnes and V. K. La Mer (*J. Amer. Chem. Soc.*, 1942, **64**, 2312—2316).—The kinetics of the reaction at 25° between phenolphthalein (I) and NaOH (0.006—0.020M.) with and without addition of NaCl have been investigated spectrophotometrically. No perceptible secondary salt effect exists. The limiting slope of $\log k$ (carbinol formation const.) against $\mu^{\frac{1}{2}}$ (μ = ionic strength) indicates that carbinol formation involves reaction between a doubly-charged negative ion of (I) with OH^- : $\text{R}'' + \text{OH}^- \rightarrow \text{ROH}'''$ (I), but $\log K$ (equilibrium const.) against $\mu^{\frac{1}{2}}$ gives a limiting slope half that predicted by equation (I) and this suggests that ROH''' is partly hydrolysed, $\text{ROH}''' + \text{H}_2\text{O} \rightleftharpoons \text{RHOH}'' + \text{OH}^-$. W. R. A.

Tracer studies with radioactive carbon. Synthesis and oxidation of three-carbon acids. P. Nahinsky, C. N. Rice, S. Ruben, and M. D. Kamen (*J. Amer. Chem. Soc.*, 1942, **64**, 2299—2302).—Syntheses, using ^{14}C , are described for: $\text{Et}^{14}\text{CO}_2\text{H}$, $\text{OH}\cdot\text{CHMe}\cdot^{14}\text{CO}_2\text{H}$, and $\text{OH}\cdot[\text{CH}_2]_2\cdot^{14}\text{CO}_2\text{H}$. On oxidation with alkaline KMnO_4 each anion yields 1 mol. of $\text{CO}_3^{''}$ and 1 mol. of $\text{C}_2\text{O}_4^{''}$. The % of ^{14}C in the $\text{CO}_3^{''}$ and $\text{C}_2\text{O}_4^{''}$ have been measured for different concns. of NaOH and ratios of α -C- β -C bond rupture to α -C- CO_2H bond rupture have been calc. The α - β carbon linking at $[\text{OH}^-] > 2N$. is broken $2\frac{1}{2}$ times as often as the α -C- CO_2H for all three anions, and this suggests that lactate or $\text{OH}\cdot[\text{CH}_2]_2\cdot\text{CO}_2^-$ is an intermediate in the oxidation of propionate. At $[\text{OH}^-] > 2N$, α - β rupture in EtCO_2^- is greatly increased but in the other two it is unaltered. Therefore the α - β linking in EtCO_2^- is broken before either position is hydroxylated. A tentative scheme for oxidation of EtCO_2^- is suggested. W. R. A.

Influence of reaction mechanism on size distribution in polymerides. E. F. G. Herington and A. Robertson (*Trans. Faraday Soc.*, 1942, **38**, 490—501).—Kinetic study of a polymerisation in conjunction with size distribution data, when growth occurs by addition of a monomeride, enables the reaction to be classified with respect to its mechanism, and affords information about the dependence of the ratio of the velocity coeff. of propagation to that of the termination reaction on the chain length. The relations indicated are developed for some simple cases. F. L. U.

Catalytic effect of electrolytes on solvolytic reactions. L. F. Audrieth, L. D. Scott, and O. F. Hill (*J. Amer. Chem. Soc.*, 1942, **64**, 2498—2499).—The influence of salts on the aminolysis of $\text{CH}_2\text{Ph}\cdot\text{CO}_2\text{Et}$ in NH_2Bu^a at 25° and on the ammonolysis of EtOBz in liquid NH_3 at 0° has been investigated. Small amounts of neutral salts speed up the solvolytic reaction. The catalytic effect of equimol. concn. of these salts is \ll that for the corresponding "onium" salts. What has previously been considered as evidence of acid catalysis in basic solvents by the solvated proton may be a special case of electrolyte catalysis. W. R. A.

Acid-catalysed hydrolysis of phenyl-substituted aliphatic esters. H. A. Smith and R. R. Myers (*J. Amer. Chem. Soc.*, 1942, **64**, 2362—2365).—The acid-catalysed hydrolysis in 70% COMe_2 has been investigated for Et phenylacetate, β -phenylpropionate, γ -phenylbutyrate, δ -phenylvalerate, hydratropate, phenylethylacetate, diphenylacetate, and cyclohexylacetate. Reaction rates are decreased by introducing Ph into an aliphatic ester, probably on account of steric effects. The effects of Ph substitution on acid hydrolysis, saponification, and esterification are compared. W. R. A.

Tracer studies with radioactive hydrogen. (A) **Synthesis of labelled methyl iodide.** (B) **Menschutkin reaction.** D. Harman, T. D. Stewart, and S. Ruben (*J. Amer. Chem. Soc.*, 1942, **64**, 2293—2294, 2294—2296).—(A) Prep. of $^{11}\text{CH}_3\text{I}$ (from $\text{H}^{11}\text{CO}_2\text{H}$ via Na salt, Me ester, and $^{11}\text{CH}_3\cdot\text{OH}$, using CuO-CrO_3 catalyst, then HI) and of $\text{C}^3\text{H}^1\text{H}_2\text{I}$ (I) (from HCO_2Me and $^3\text{H}^1\text{H}$; then as for $^{11}\text{CH}_3\text{I}$) is described.

(B) Reaction between excess of NMe_3 or NPhMe_2 and (I) in EtOH or C_6H_6 yields a quaternary salt in which all the ^3H from (I) is found, indicating that there is no reaction intermediate reversibly formed in which the I^+ ion is detached from the $\text{C}^3\text{H}^1\text{H}_2$. W. R. A.

Catalytic properties of charcoal. IV. Factors influencing the indophenol reaction. C. Schwob [with J. E. Biegner, K. J. Carson, and G. V. Scott] (*J. Amer. Chem. Soc.*, 1942, **64**, 2276—2279).—The production of indophenol (I) by oxidation of a mixture of α - $\text{C}_{10}\text{H}_7\cdot\text{OH}$ (II) and p - $\text{C}_6\text{H}_4(\text{NH}_2)_2$ (III) by O_2 or H_2O_2 in presence of C \propto the amount of C used, decreases as (II) concn. increases, is not sensibly affected by the concn. of (III), and increases as $[\text{H}^+]$ decreases. The production appears to involve several simultaneous and successive processes and does not constitute an adequate test of the activity of the C. W. R. A.

[Catalytic] cyclisation of hydrocarbon mixtures.—See B., 1943, II, 1.

Catalytic hydrogenation of sulphonated lignin.—See B., 1943, II, 12.

Citrate additions to cuprous cyanide plating solutions.—See B., 1943, I, 33.

Electrodeposition of lead from acetate solution.—See B., 1943, I, 35.

Electrolytic deposition of silver-lead alloys.—See B., 1943, I, 35.

Hard chromium-plating of aluminium alloys.—See B., 1943, I, 38.

[Electrodeposition of chromium.]—See B., 1943, I, 35.

Cathode films in tungstate-containing plating baths.—See B., 1943, I, 36.

Electrodeposition of gold alloys.—See B., 1943, I, 36.

Rhodium plating.—See B., 1943, I, 36.

Electrolysis of Grignard reagents. Short-lived free radicals in ethyl ether.—See A., 1943, II, 49.

Photo-combination of hydrogen and chlorine in oxygen-free systems. M. Ritchie and D. Taylor (*Proc. Roy. Soc.*, 1942, **A**, **180**, 423—451).—The photo-synthesis of HCl was studied under varied conditions of light intensity and of H_2 , Cl_2 , HCl, N_2 , and A pressures. The inhibiting actions of Cl_2 and HCl are confirmed. With increasing pressure of HCl the quantum efficiency decreases, but with Cl_2 , N_2 , and A max. are observed at intermediate pressures. A scheme for the initiation and propagation of reaction chains is proposed. G. D. P.

Photo-oxidation of methyl iodide. W. J. Blaedel, R. A. Ogg, jun., and P. A. Leighton (*J. Amer. Chem. Soc.*, 1942, **64**, 2500—2501).—A new mechanism for the photo-oxidation of MeI, involving formation of a peroxide as an intermediate but not formation of OH, has been proposed. In this mechanism the reaction $\text{Me} + \text{I} \rightarrow \text{MeI}$ is negligible compared with $\text{Me} + \text{I}_2 = \text{MeI} + \text{I}$. W. R. A.

Attempted detection of free hydroxyl as an intermediate in photo-chemical reactions. W. J. Blaedel, R. A. Ogg, jun., and P. A. Leighton (*J. Amer. Chem. Soc.*, 1942, **64**, 2499—2500).—The attempted detection by absorption spectral methods of free OH formation proved unsuccessful for each of the following: $\text{MeI} + \text{O}_2 + h\nu$; $\text{H}_2\text{O}_2 + h\nu$; $\text{H}_2\text{O}_2 + \text{Hg} + h\nu$; $\text{H}_2\text{O} + \text{Hg} + h\nu$; $\text{H}_2 + \text{O}_2 + \text{Hg} + h\nu$; $\text{MeOH} + \text{Hg} + h\nu$. Therefore, in the last five reactions, the steady state concn. of OH was $< 5 \times 10^{-5}$ mm. W. R. A.

Photo-enolisation of ketones. T. Iredale (*Nature*, 1942, **150**, 579).—In absence of O_2 anhyd. COMe_2 reacts with I after absorption of ultra-violet light, presumably owing to a shift of the equilibrium in the direction of the enol form. The effect is much less pronounced if I is added in the dark to pre-irradiated COMe_2 ; hence catalytic hastening of the attainment of normal equilibrium is unlikely. Irradiated liquid COMe_2 gave no detectable amount of MeI or Ac, (cf. A., 1939, I, 330). A. A. E.

IX.—METHODS OF PREPARATION.

Action of fatty acids on copper. R. Dubrisay (*Compt. rend.*, 1941, **213**, 837—839; cf. A., 1939, I, 254).—A Cu wire is immersed in buffer solutions covered with a PhMe solution of palmitic or stearic acid. Cu stearate or palmitate is pptd. at the interface. Pptn. is more rapid in solutions of pH > 6.95 whilst in the buffer solutions alone Cu ions appear in the aq. solution most rapidly at pH < 6.95 . O. D. S.

Tervalent salts of copper and silver. II. L. Malatesta (*Gazzetta*, 1941, **71**, 580—584).—Boiling aq. TeO_2 , KOH, and CuSO_4 (or Ag_2SO_4) with $\text{K}_2\text{S}_2\text{O}_8$ give a solution which with Na_2SO_4 yields the *Na cupri*(Cu^{III})- and *argenti*(Ag^{III})-tellurates, $\text{Na}_6\text{H}_4[\text{Cu}^{\text{III}}(\text{TeO}_6)_2] \cdot 18\text{H}_2\text{O}$, $\text{Na}_7\text{H}_2[\text{Cu}^{\text{III}}(\text{TeO}_6)_2] \cdot 12\text{H}_2\text{O}$, $\text{Na}_6\text{H}_3[\text{Ag}^{\text{III}}(\text{TeO}_6)_2] \cdot 18\text{H}_2\text{O}$, and $\text{Na}_7\text{H}_2[\text{Ag}^{\text{III}}(\text{TeO}_6)_2] \cdot 14\text{H}_2\text{O}$. HAuCl_4 , KOH, and K_2TeO_4 , followed by Na_2SO_4 , give *Na auri-tellurate*, $\text{Na}_6\text{H}_3[\text{Au}^{\text{III}}(\text{TeO}_6)_2] \cdot 14\text{H}_2\text{O}$. E. W. W.

Preparation and properties of trimeric phosphonitrilic chloride. R. Steinman, F. B. Schirmer, jun., and L. F. Audrieth (*J. Amer. Chem. Soc.*, 1942, **64**, 2377—2378).—Phosphonitrilic chlorides have been prepared by heating a mixture of PCl_5 and (usually excess of) NH_4Cl for 4—6 hr. at 145—160°. Predominantly the tri- and tetramerides were formed and were separated by fractional distillation under 12—14 mm. at 140°. The trimeride, recryst. from hot glacial AcOH and fractionally sublimed at 100°/ > 1 mm., has v.p. given by $\log p = -3978/\theta + 11.187$ ($\theta = 75.2$ — 114.9°) and $-2880/\theta + 8.357$ ($\theta = 114.9$ — 189.3°). W. R. A.

Formation of complex tungsto-tartrates. (Miles.) M. Cordier and M. Murgier (*Compt. rend.*, 1941, **213**, 836—837).—A study of the optical rotation of solutions of Na tungstate, tartaric acid (I), and HCl indicates the formation of a complex $\text{WO}_3 \cdot \text{C}_4\text{H}_6\text{O}_6$ with rotation 15—30 times that of (I) and showing mutarotation. The salt $\text{Na}_2[\text{WO}_3 \cdot \text{C}_4\text{H}_6\text{O}_6]$ is formed by neutralisation. O. D. S.

Alkali pyroiodates: their existence and mechanism of formation. U. Croatto and G. Bryk (*Gazzetta*, 1941, **71**, 590—596).— I_2O_5 (from I in CCl_4 and N_2O_5 ; method described) with KIO_3 and RbIO_3 at 170° gives the *pyroiodates*, KI_3O_8 , m.p. 316°, and RbI_3O_8 , m.p. 340°, also obtained by heating $\text{KH}_2\text{I}_3\text{O}_9$ (at 160°) and $\text{RbH}_2\text{I}_3\text{O}_9$ (at 150°) in vac. in presence of P_2O_5 . E. W. W.

Study of corrosion products of iron by means of X-rays and electron diffraction. N. A. Schischakov and P. S. Moiseev (*J. Phys. Chem.*

Russ., 1941, 15, 101—108).—The oxide film on Fe abraded under H_2O consists of γ -FeOOH. The rust on Fe kept under H_2O for 1—3 months consists of γ -FeOOH and γ -Fe $_2$ O $_3$. J. J. B.

Basic indium salicylates.—See A., 1943, II, 33.

X.—ANALYSIS.

Methods of chromatography. F. A. Robinson and A. L. Bacharach (*Ind. Chem.*, 1942, 18, 456—460).—A review.

Determination of mol. wt. by precipitation-titration. B. Jirgensons (*J. pr. Chem.*, 1942, [ii], 161, 30—48).—This new method of mol. wt. determination is applicable to the members of various series of homologous polymerides of mol. wt. 10^2 — 5×10^5 . It depends on the fact that in such a series the solubility decreases with increasing mol. wt. The weight of pptg. agent required to start pptn. of members of the series is determined. The theory of the method is given. The error is 5—30%, and the range of greatest accuracy is for mol. wt. 5×10^2 — 5×10^4 . A. J. M.

Absorption spectrophotometry in pharmaceutical analysis.—See B., 1943, III, 19.

Determination of chlorine in fat of flour.—See B., 1943, III, 13.

Alkalimetric standardisation of iodine solutions. F. L. Hahn (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 773).—The reaction $SO_3^{''} + H_2O + I_2 = SO_4^{''} + 2HI$ is utilised. The I solution is decolorised by means of aq. Na_2SO_3 or K_2SO_3 made slightly alkaline to thymolphthalein. The HI is then titrated with standard NaOH (phenolphthalein). L. S. T.

Gas analysis with mass spectrometer. J. A. Hipple (*J. Appl. Physics*, 1942, 13, 551—560).—Published work on determination of traces of O_2 in N_2 , analysis of hydrocarbon mixtures, gas quantities <0.1 c.c., and tracer analysis is reviewed. A 90°-deflexion instrument is described. L. J. J.

Volumetric determination of sulphates. Tetrahydroxybenzoquinone as an external indicator. S. W. Lee, J. H. Wallace, jun., W. C. Hand, and N. B. Hannay (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 839—840).—A drop of 10% aq. solution of the Na salt of tetrahydroxybenzoquinone on filter-paper is used as indicator, and the first change from yellow to pink taken as the end-point. An indicator blank must be applied. H_2SO_4 solutions are first neutralised with aq. NH_3 . Al^{+++} is pptd. by means of aq. NH_3 , and large amounts of NaCl do not interfere. L. S. T.

Standardisation and stability of 0.1N-sodium thiosulphate solutions in hot weather. S. O. Rue (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 802—805).—An improved $K_2Cr_2O_7$ method for standardising 0.1N- $Na_2S_2O_3$, particularly at 30—40°, is described. The method is accurate to 0.07% between 23° and 40°. The Vosburgh (A., 1922, ii, 863) and the Willard-Furman methods give, at 40°, high and slightly erratic results. The accuracy of the different $K_2Cr_2O_7$ methods was checked against pure I. Data for 0.1N- $Na_2S_2O_3$ solutions treated in various ways and stored at 20° and 40° for ~4 months are recorded. Untreated solutions showed a max. variation in normality of 0.3—0.4%. $CHCl_3$ and HgI_2 are the best stabilisers, but are effective for only 2 months at 40°. NaOH and Na_2CO_3 accelerate the decomp. of aq. $Na_2S_2O_3$ at this temp. L. S. T.

Source of error in determination of nitrogen.—See B., 1943, I, 23.

Perchloric acid in micro-Kjeldahl digestions. L. F. Wicks and H. I. Firminger (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 760—762).—Results obtained by well-known digestion procedures on samples of serum, milk, urine, protein-free blood filtrates, and haemolysed blood show that the use of $HClO_4$ can cause serious loss of N_2 . This is particularly significant in micro-determinations. Addition of $HClO_4$ to hot $(NH_4)_2SO_4$ - H_2SO_4 solution removes N_2 . The use of $HClO_4$ in these digestions is deprecated. L. S. T.

Kjeldahl distillation without absorbing acid. J. A. Bradley (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 705—706).— NH_3 is distilled into H_2O , and titrated directly with standard acid (Me-red or -orange). Loss during distillation is prevented by using a closed still fitted with a small rubber balloon to relieve excess pressure. Test data show that the results obtained are slightly more accurate than those given by the usual method in which absorbing acid is used. With a closed still and absorbing acid even better results are obtained. Different excesses of acid have no effect on accuracy. L. S. T.

Determination of ammonia by a diffusion method. A. N. Prater, E. J. Cowles, and R. P. Straka (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 703—705).— NH_3 or other volatile base is liberated in a Petri dish by means of 4% aq. NaOH or of a solution saturated with $NaBO_2$ and KCl, and absorbed in drops of a saturated solution of H_3BO_3 in glycerol suspended from the cover of the dish. After absorption is complete (3 hr. at room temp.) the drops are washed into a flask and titrated electrometrically, or by means of 0.01N-HCl (Me-red-bromocresol-green). Data for standard aq. $(NH_4)_2SO_4$ and a meat extract are given. The method is suitable for 0.1—9 mg. of NH_3 -N. L. S. T.

Micro-analysis of gases. Nitric oxide-hydrogen, nitric oxide-nitrogen, and nitrous oxide-ammonia mixtures. R. N. Smith and P. A. Leighton (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 758—759).— NO is removed by adding O_2 in presence of KOH, and determined by difference from analysis of the remaining gas. NH_3 is separated from N_2O by absorption on a fused bead of CH_2Cl-CO_2H . An improved combustion coil is described. L. S. T.

Colorimetric micro-determination of phosphorus. C. P. Sideris (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 762—764).—The Berenblum-Chain method (A., 1938, I, 211) is improved by using $Sn + HCl$ instead of $SnCl_2$ in HCl, replacing EtOH by Bu^aOH for washing the funnel and diluting the blue phosphomolybdate compound, and heating the unknown with 2N- H_2SO_4 and NH_4 molybdate. L. S. T.

Adaptation of an indirect method for potassium to the photo-electric colorimeter. C. P. Sideris (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 821—822).—The method described previously (A., 1937, I, 264) is improved by using a photo-electric colorimeter with appropriate light filters. Optimum ranges are 0.5—15 μg . of K and 1.0—30 μg . of Co. L. S. T.

Solubility of strontium chromate and the detection of strontium. T. W. Davis (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 709—711).—Data for the solubility of $SrCrO_4$ in H_2O and in aq. EtOH at 25°, 50°, and 75° are recorded. Solubility diminishes slightly with a rise in temp. $SrCrO_4$ in contact with H_2O undergoes a very slow hydration at room temp., and this, like the formation of a saturated solution at the same temp., is incomplete after 1 year. The Noyes method for the alkaline earths is accelerated by pptg. and filtering $SrCrO_4$ in hot solution. Cooling the mixture neither eliminates possible pptn. of $CaCrO_4$ nor promotes more complete removal of Sr^{++} . L. S. T.

Relation of alkaloidal to inorganic chemistry. Bromoauric acid as reagent for inorganic microcrystal tests. C. C. Fulton (*J. Amer. Pharm. Assoc.*, 1942, 31, 177—182).— $HAuBr_4$ in H_3PO_4 , which is a valuable reagent for the detection of feebly basic amines (e.g., NH_2Me), may also be used for identification of Mg, Zn, Cd, Na, Li, K, NH_4 , Rb, and Cs, by application to the dry salt. Typical cryst. forms are obtained with Mg and Na. P. G. M.

Determination of zinc and cadmium by precipitation with sodium anthranilate. H. Funk (*Z. anal. Chem.*, 1942, 123, 241—244).—After removal of acid by evaporation and addition of dil. aq. Na_2CO_3 (Me-red), Zn is pptd. hot (A., 1933, 244), and the ppt. dried at 105—110° (factor, 0.1936). Cd is pptd. hot, and filtered cold (factor 0.2922). Interference by Cl^- is much more marked with Cd than with Zn. A. A. E.

Evaluation of metallic zinc in zinc dust.—See B., 1943, I, 34.

Analytical use of sodium rhodizonate [detection of lead]. F. Feigl and H. A. Suter (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 840—842).—The reactions between Na rhodizonate and neutral or tartaric acid-tartrate (pH 2.8) solutions containing Ag^+ , Hg^+ , Tl^+ , Pb^{++} , Cu^{++} , Hg^{++} , Cd^{++} , Bi^{+++} , Zn^{++} , UO_2^{++} , Ba^{++} , Sr^{++} , Sn^{++} , Fe^{++} , and Fe^{+++} are described. The prep. of blue-violet coloured $PbC_6O_6 \cdot Pb(OH)_2 \cdot H_2O$ from neutral solution, and of scarlet-red coloured $2PbC_6O_6 \cdot Pb(OH)_2 \cdot H_2O$ from a tartrate-tartaric acid buffer (pH 2.8), is detailed. The use of these compounds for the detection of Pb in presence of $TlCl$, Hg_2Cl_2 , and $AgCl$, in presence of Ba^{++} , in Pb ores and minerals, in alloys, in Pb pigments, and in glass is described. As a drop reaction in a neutral solution of a Pb salt the limit of identification is 0.1 μg . ($1:5 \times 10^5$). The detection of Ba and Sr in the carbonate ppt. of the alkaline-earth metals is described. L. S. T.

Detection of lead in power petrol.—See B., 1943, I, 18.

Conversion of iron into ferrocyanide. Precipitation of vanadium ferrocyanide. B. S. Evans (*Analyst*, 1942, 67, 355—356; cf. B., 1928, 786).—Sufficient Na_2CO_3 is added to the HCl- HNO_3 solution of the steel in the presence of citric acid to dissolve any pptd. WO_3 . KCN is then added and SO_2 passed until the reduction is complete and before any tendency towards formation of a blue tinge is apparent. The solution is boiled for 10 min. and should give no blue ppt. with a few drops of HCl. V is then pptd. as a dusty yellow ppt. of $VFe(CN)_6$ on adding more HCl. S. B.

Determination of iron, manganese, and magnesium in pharmaceutical preparations by means of 8-hydroxyquinoline.—See B., 1943, III, 19.

Zinc-reduction method for determination of iron.—See B., 1943, I, 33.

Analysis of chromic acid anodising baths.—See B., 1943, I, 37.

XI.—APPARATUS ETC.

Heating device for micro-beakers, flasks, and centrifuge tubes. C. R. Noller (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 834). L. S. T.

Helium liquefaction without pre-cooling with liquid hydrogen. W. Meissner (*Physikal. Z.*, 1942, 43, 261—274).—A liquefier similar in principle to that of Kapitza (cf. A., 1935, 57) is described in detail.

The expansion engine, operated by He at 30 atm. pre-cooled by liquid air, cools the gas to 14° K. A new inversion curve for the differential Joule-Thomson effect in He supports changes from the pressure and temp. relationships in Kapitza's liquefier. When steady conditions are reached the liquefier requires ~3 kg. of liquid air, and produces 2—2.8 l. of liquid He per hr. A. J. E. W.

Colour pyrometry. H. Schmidt (*Z. tech. Physik*, 1942, 23, 88—89).—A modified colour pyrometer is described and data obtained by it for a W band lamp are compared with existing data. W. R. A.

Heat capacity of organic vapours. III. Comparison of flow calorimeters. J. B. Montgomery and T. De Vries (*J. Amer. Chem. Soc.*, 1942, 64, 2372—2375).—From an examination of the utility of various flow calorimeters in determining C_p for org. vapours, the simple apparatus of Callendar is preferred. A recycling vaporiser for producing a const. rate of flow of vapour has been designed. W. R. A.

Dispersion of liquids and solutions. I. New spectro-interferometric method for the accurate measurement of refractive index between 1.0 and 0.2 μ . W. Geffcken and A. Kruis (*Z. physikal. Chem.*, 1940, B, 45, 411—437).—A Rayleigh interferometer, interposed between the collimator and prism of a spectrograph, produces three or four interference lines for every spectral line. n can thus be measured for each separate λ over a range limited only by the material of the apparatus. The accuracy of measurement with a 1-mm. cell is $\pm 1 \times 10^{-5}$, provided that correction consts. for the apparatus are applied. Constructional and operational details of the apparatus are given. W. R. A.

Fluorescent microscope lamp. L. H. Berkelhamer (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 833—834).—The lamp described gives sufficient light for high-power microscopy and low-magnification photomicrography without undue heat radiation. L. S. T.

Development of the prism spectroscope since the time of Kirchhoff and Bunsen. G. Hansen (*Physikal. Z.*, 1942, 43, 213—217).—A review of developments in design. A. J. E. W.

Comparison of the intensities of X-ray interferences of different objects. Construction of a comparison camera for fibre photographs. O. Kratky, F. Schossberger, and A. Sekora (*Z. Elektrochem.*, 1942, 48, 409—418).—The conditions necessary for obtaining comparable records of X-ray interference patterns are discussed. A comparison camera which brings the two preps. into the X-ray beam for short periods alternately and throws the images on the same film is described. The intensities of the images are compared photometrically. The application of the method to the comparison of the structures of alkali- and CS_2 -treated cellulose is described. J. W. S.

Rapid X-ray diffraction method. A. T. McCord (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 793—796).—The powdered sample is pressed into a rigid rod 3 mm. in diameter, and is inserted in the camera to form one side of the defining slit. Cryst. powders can be identified irrespective of their coeffs. of absorption, and an optimum set of conditions can be defined for any mixture of two or more substances. L. S. T.

Microradiography by reflexion. J. J. Trillat (*Compt. rend.*, 1941, 213, 833—836).—The structure of alloys containing atoms of widely different at. wts. is photographed by applying a film insensitive to X-rays to a plane surface of a macro-specimen and illuminating with X-rays. The image is formed by the emitted photoelectrons. O. D. S.

Electrical ignition of the spectrographic arc. F. G. Brockman and F. P. Hochgesang (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 796).—A circuit that enables an arc to be struck instantaneously with the electrodes separated at the working distance is described. L. S. T.

Measurement of relative abundance with mass spectrometer. E. B. Jordan and N. D. Coggeshall (*J. Appl. Physics*, 1942, 13, 539—550).—Isotopic abundance measurements are subject to small errors due to the effect of the crossed electric and magnetic fields on the electron beam, and to space-charge effects on ionic paths. With both sector and π radian type instruments measurements are subject to a max. error of 1—2%. Curves giving crit. consts. for mass spectrometers are given. L. J. J.

Linearity of the mass scale of Aston's mass spectrograph. J. B. Seth and C. V. H. Rao (*Indian J. Physics*, 1942, 16, 219—227).—Mathematical. The most linear portion of the mass-distance curve has been investigated using considerations of pure geometry and of co-ordinate geometry. The results agree. W. R. A.

All-glass burette system. T. F. Lavine (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 739).—The side-arm is connected to the storage bottle by means of ball-and-socket joints. L. S. T.

Apparatus for iodometric determination of tin. W. M. Rumberger (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 801). L. S. T.

Location of the end-point on certain graphical titration curves. A. Lange and D. P. Stevenson (*Ind. Eng. Chem. [Anal.]*, 1942, 14,

770—773).—Equations for certain types of titration curves are derived. Possible methods for finding the end-point graphically are described. L. S. T.

Steam-distillation apparatus for micro-Kjeldahl analysis.—See A., 1943, III, 76.

Pyrex brand glass wool as a filtering medium. G. B. Heisig (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 766).—Dil. HCl extracts Al^{+++} from glass wool, Pyrex brand glass No. 719. After repeated extraction, and thorough washing, traces of Al^{+++} are still removable. L. S. T.

Device for use in making powder specimens for a high-temperature X-ray camera. H. Lipson and O. S. Edwards (*J. Sci. Instr.*, 1942, 19, 186).—A holder for use in sealing a SiO_2 rod into a thin-walled SiO_2 tube is figured. A. A. E.

Laboratory-type air separator. G. D. Joglekar (*J. Indian Chem. Soc., Ind. Ed.*, 1942, 5, 102—106).—The construction of a laboratory cyclone-type air separator is described. The ground mass is taken by the air-blast into a cylindrical chamber in which coarse particles are removed. The chamber is connected by an outlet pipe to a dust box and filter bags. R. J. W. R.

Cutting wide-bore glass tubing and repairing partly broken chemical glassware. H. F. Taylor (*Chem. and Ind.*, 1942, 531—532).—The scratch flanked by wet paper bands need be only 0.5 in. long, and the tube is rotated rapidly in a batwing flame. Winchester quart bottles and Pyrex beakers may be cut. A. A. E.

Laboratory shaking machine.—See A., 1943, III, 75.

Simple test-tube rack and comparator. Nomographic chart for colorimeter. Simplification of fluorescence microscopy. Mercury vacuum release for ultrafiltration etc.—See A., 1943, III, 76.

[Review of] laboratory apparatus progress. R. H. Powell (*Paint Manuf.*, 1942, 12, 128—129, 155). D. R. D.

XIII.—GEOCHEMISTRY.

Why the sea is salt. C. H. White (*Amer. J. Sci.*, 1942, 240, 714—724).—A discussion. L. S. T.

Geology and metamorphism in the McVeigh Lake area, N. Manitoba. J. D. Bateman (*Amer. J. Sci.*, 1942, 240, 789—808). L. S. T.

Pyrrhotite; melting relationships and composition. E. Jensen (*Amer. J. Sci.*, 1942, 240, 695—709).—The field of stability of pyrrhotite is reproduced from existing data and from new data obtained for the system FeS-Fe by the differential heating-cooling curve method. The mixtures were sealed in specially-designed SiO_2 glass containers to prevent oxidation and loss of S at high temp. A prep. corresponding with the formula FeS melts over a large temp. range with dissociation into a solid richer in S and a liquid richer in Fe. An increase in S content raises melting temp. to a max. where the composition $\text{Fe}_{12}\text{S}_{13}$ melts sharply like a single compound. Mixtures with more Fe than corresponds with FeS show eutectic melting. L. S. T.

Structures of thuringite, bavalite, and chamosite, and their place in the chlorite group. W. von Engelhardt (*Z. Krist.*, 1942, 104, 142—159).—Thuringite (I) from Schmiedefeld and Zirmsee, and bavalite from Brittany, belong to the chlorite group, and may be considered to be the Fe-rich terminal members of the series. The lattice consts. of these minerals have been determined. Chamosite (II) from Schmiedefeld has a structure very similar to that of chlorite, but there are deviations. The fact that the elementary cell of (II) is of greater vol. than that of (I) indicates that (I) is probably a metamorphic product of (II). A. J. M.

Crystal structure of $\alpha\text{-AlOOH}$ (diaspore). II. Fourier analysis. W. Hoppe (*Z. Krist.*, 1942, 104, 11—17; cf. *ibid.*, 1940, 103, 73—89).—A Fourier projection of the structure on (001) is constructed from photometric intensity measurements on Weissenberg-Böhm X-radiograms (Cu $K\alpha$ radiation). The recorded intensity vals. are derived by comparison with spectrometric abs. intensities for selected reflexions. Supplementary data for Mo $K\alpha$ radiation are given. The at. parameters for Al and O agree closely with those obtained by successive approximation. A. J. E. W.

Structure of leucite, KAlSi_3O_8 . S. von Náray-Szabó (*Z. Krist.*, 1942, 104, 39—44).—Oscillation and powder X-radiograms, data for which are recorded, give a 13.01, c 13.82 Å.; 16 mols. per unit cell; space-group $C_{4h}^2\text{—}I4_1/a$; the crystals are not piezoelectric. Comparison of the observed intensities with those given by analcime and pollucite confirm that the Si-Al-O structures are similar in the three minerals; the K^+ ions in leucite occupy similar positions to Cs^+ ions in pollucite, although their smaller size causes deformation of the lattice. A. J. E. W.

A., I.—General, Physical, and Inorganic Chemistry

MARCH, 1943.

I.—SUB-ATOMICS.

Fibre-spectrometer. Concave grating spectrograph. Timing device for spectrographic exposures.—See A., 1943, I, 71.

Interaction of three spectral terms. I. Kovács and S. Singer (*Physikal. Z.*, 1942, **43**, 362—371).—Solutions of the general secular equation of the third order, expressed as convergent series, are derived, and applied to the calculation of perturbation effects in mol. systems involving three interacting states. A. J. E. W.

Arc lines of copper in flame spectra. N. L. Singh (*Current Sci.*, 1942, **11**, 330—331).—The line 4651 Å. in the flame spectrum of Cu does not belong to the Cu atom but is one of the strong structure lines near the head of the (0—1) CuH band at 4650 Å.

Continuous radiation of high-pressure mercury discharge. P. Schulz (*Z. Physik*, 1942, **119**, 167—173).—New data for temp. in high-pressure Hg discharges, derived from electron-collision broadening of spectrum lines, give good agreement between observed radiation intensities in the continuum and vals. calc. from Unsöld's Hg ion recombination mechanism (A., 1939, I, 50). L. J. J.

Carbon arc at high current density. VI. Spectral energy distribution in radiation from the high-current carbon arc. W. Finkelnburg and H. Schluge (*Z. Physik*, 1942, **119**, 206—222, 527—528).—Spectral energy distribution measurements with a quartz double monochromator at 3000—13,000 Å. give temp. of 5600—6000° K. for the emitting vapour-cloud of the Beck arc. Measurements with the homogeneous C arc give a min. val. of 4120° K. for the sublimation temp. of C at atm. pressure. L. J. J.

Energy values of the $3d^8 4p$ electronic configuration of cobalt. M. T. Antunes (*Physical Rev.*, 1942, [ii], **62**, 362—368).—Mathematical. The calc. energy vals. confirm the assignments of Russell *et al.* (cf. A., 1940, I, 423). N. M. B.

Origin of the coronium lines. A. Hunter (*Nature*, 1942, **150**, 756—759).—A review of all previous attempts to trace the origin of the broad bright lines superposed on the continuum in the spectrum of the inner solar corona and Edlén's (*Arkiv astron., mat. fysik*, 1941, **28B**, 1) recent attribution of 22 lines (practically the whole spectrum) to forbidden transitions in very highly ionised atomic emitters, namely, Fe x, Fe xi, Fe xiii, and Fe xiv; Ni xii, Ni xiii, Ni xv, and Ni xvi; Ca xii and Ca xiii; the prominent green line at 5303 Å., for example, being ascribed to Fe xiv ($^2P_{1/2} \rightarrow ^2P_{3/2}$). W. J.

Night illumination and energy distribution in the spectrum of the night sky. P. P. Feofilov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 228—232).—Curves are given showing the variation during one night of the total illumination on a horizontal surface, obtained by photometric comparison with the const. luminosity of K uranyl sulphate crystals. Variations not due to cloud are discussed. A spectral energy distribution curve, showing pronounced max. at ~5600 and 5900 Å., is also given; the night sky radiation is yellower than that of a black body at 4000° K. A. J. E. W.

Method for study of variation of emission lines in the spectrum of the night sky. G. Schain (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 138—141).—Difficulties involved in photographing the spectrum of the night sky are discussed, and a procedure for avoiding them is outlined. Improvements include the widening of the slit and the use of a step-slit. The method suggested is reliable for lines of strong intensity in the visual region. A. J. M.

Investigation of X-radiation from ^{121}Te (125 days) by critical absorption and fluorescence. R. D. O'Neal and (Mrs.) G. Scharff-Goldhaber (*Physical Rev.*, 1942, [ii], **62**, 401).—A correction of Fig. 1 (cf. A., 1942, I, 381). N. M. B.

Intensities of monochromatic continuous X-rays from atomic targets of nickel. K. Harworth and P. Kirkpatrick (*Physical Rev.*, 1942, [ii], **62**, 334—339).—Measurements with an A-filled ionisation chamber of intensities from a thin (199 Å.) Ni target under 12—180-kv. electron bombardment were corr. for all absorptions in the path of the radiation, for radiation from sources other than the target, and for finite target-thickness. The corr. relative intensities per unit λ interval as produced by electron bombardment of independent Ni atoms show variation with bombardment energy in

excellent agreement with the Sommerfeld theory, and variation with λ in approx. agreement. N. M. B.

Determination of life of metastable excited states of neon from residual current measurements in luminous discharges. A. Hoffmann (*Z. Physik*, 1942, **119**, 223—236).—Metastable excited atoms remaining after extinction of luminous discharges in Ne and Ne-A mixtures give rise to residual currents from which their life and mechanism of deactivation can be found. Ionisation arises by collision between two such metastable atoms. The effect of pressure shows deactivation to be a wall and not a homogeneous reaction. Metastable Ne, with a mean life of 0.3 sec., has a smaller effective area in diffusion than normal Ne. The ionisation probability on collision with A is 3×10^{-3} . L. J. J.

Ranges of secondary electrons in magnesium. R. Truell (*Physical Rev.*, 1942, [ii], **62**, 340—348).—An examination, with high-energy primary electrons, of the secondary electron emission ratio as a function of the thickness of Mg layers evaporated on a C backing leads to an expression for the ranges of secondary electrons as a function of their energy at the point of production. An analysis of results leads to relations between, and vals. for, the quantities involved in the expression. The depth of origin of secondary electrons in the energy range 10—200 v. is 2×10^{-7} — 4×10^{-5} cm. N. M. B.

Cathodic sputtering. II. Determination of the edge factor. III. Incomplete covering of the cathode with the anomalous glow discharge. IV. Dispersion of the primary vaporised particles. A. Günther-Schulze (*Z. Physik*, 1942, **119**, 79—86, 86—92, 92—99; cf. A., 1943, I, 2).—II. Correction for the fact that the cathode and receiving surfaces are not infinite parallel planes is worked out.

III. If the cathode is near the walls of the vessel, as it is if the cathode is to be cooled, the discharge is repelled electrostatically. There is a dead zone on the cathode, the width of which is \propto dark space. This leads to erroneous results for c.d.

IV. Up to drops of 1000 v. all the metals investigated behaved according to the normal law of diffusion, even close to the cathode, but at 3000 v. no metal shows normal diffusion at 30 cm. from the cathode. A. J. M.

Measurement of electronic charge. T. H. Laby (*Nature*, 1942, **150**, 648—649).—The most reliable measurements of e by oil-drop and X-ray methods are briefly reviewed. The result of the most recent determination (Hopper and Laby, A., 1942, I, 2) by an oil-drop method, $(4.802_0 \pm 0.001_3) \times 10^{-10}$ e.s.u., agrees with the mean of four independent determinations (Bäcklin, Tyrén, Söderman, and Bearden) by the X-ray method, namely $(4.802_3 \pm 0.001) \times 10^{-10}$ e.s.u. The chief source of error in oil-drop methods is still the uncertainty of η for air. W. J.

Theory of the mass-radiator. A. A. Glagoleva-Arkadieva (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 540—542).—A theoretical treatment is given of a radiation source which consists of a suspension of metal particles in a dielectric liquid subjected to a high p.d., which affords radiation of frequency $\sim 3.6 \times 10^{12}$ H., excited by sparking between particles. The radiation is emitted by Hertz vibrators comprising pairs of the particles or aggregates. Expressions for the λ of the radiation and the energy stored in the system are considered. A. J. E. W.

Mobilities in nitrogen at high current densities. W. H. Bennett (*Physical Rev.*, 1942, [ii], **62**, 369—371; cf. A., 1942, I, 161).—A point-to-hemisphere discharge was used for measuring free electron mobility coeffs. in mixtures of H_2 and N_2 and in pure N_2 . Consistent results require the presence of a trace of H_2 or a preliminary clean-up of the tube with H_2 . N. M. B.

Did radioactive caesium exist at an earlier period in the earth's history? Barium and strontium from pollucite. O. Hahn, F. Strassmann, J. Matthauch, and H. Ewald (*Naturwiss.*, 1942, **30**, 541—542).—If a radioactive isotope of Cs existed at some earlier time in the earth's history, but has now completely disintegrated, Ba should have been formed from it by β -ray disintegration. Wahl has found ^{132}Ba , but no ^{138}Ba , in the residue from the action of H_2SO_4 on the Cs mineral, pollucite. The investigation has been repeated by a different method with pollucite from a different source. No line due to ^{132}Ba could be found, and the distribution of Ba isotopes in the mineral was the same as for ordinary Ba.

The line for ^{87}Sr was particularly strong and that for ^{88}Sr weak, in the Sr from pollucite, in contrast to ordinary Sr. A. J. M.

Experimental evidence of the existence of element 85 in the thorium family. A. Leigh-Smith and W. Minder (*Nature*, 1942, 150, 767—768).—The emanation was blown between oppositely charged Cu sheets, element 85 then being sublimed from the negative electrode on to a cooled Ag wire which was afterwards placed in a Wilson expansion chamber. Consideration of the α - and β -tracks observed leads to the conclusion that a hitherto unknown element, probably 85, had thus been separated. The mechanism proposed involves thoron \rightarrow Th-A; then mainly Th-A \rightarrow Th-B, but to a small extent Th-A \rightarrow 85 \rightarrow $^{216}\text{Th-n}$ \rightarrow Th-C' \rightarrow Th-D. The name "anglo-helvetium" is proposed for element 85. A. A. E.

Molecular transformations accompanying the Szilard effect. R. Daudel (*Compt. rend.*, 1942, 214, 547—549).—The anions ClO_4^- , IO_4^- , SeO_4^{2-} , TeO_4^{2-} , AsO_4^{3-} , and SbO_4^{3-} in salts were subjected to the action of thermal neutrons and the state of the active atoms after dissolution in H_2O was examined. Initial and final electrovalencies for the elements Cl, I, Se, Te, As, and Sb are tabulated and plotted and results are discussed. N. M. B.

γ -Rays from ^{24}Na . C. E. Mandeville (*Physical Rev.*, 1942, [ii], 62, 309—312).—Measurements with a γ -ray spectrograph of high resolving power give energies 0.84, 1.31, 1.66, and 2.90 Me.v. with relative intensities 0.28, 0.41, 0.45, and 1.00. Results indicate excitation levels in the ^{24}Mg residual nucleus at 1.3, 2.9, and 3.7 Me.v. in partial agreement with experiments on proton scattering by Mg, but disagreeing with level schemes based on available α -ray measurements. Accuracy was checked by measurements on γ -rays from Th-(C' + C''). N. M. B.

Disintegration products from uranium irradiated with fast neutrons. Y. Nishina, K. Kimura, T. Yasaki, and M. Ikawa (*Z. Physik*, 1942, 119, 195—200).—Radioactive Rh, Ru, and Sn have been separated by chemical methods from U_3O_8 after exposure to fast neutrons obtained by bombarding Li with deuterons of energy 3 Me.v. The half-life vals. of the products are: Rh 34 hr., Ru 4 hr. and ~ 45 days, Sn ~ 70 min. and ~ 60 hr. The 4-hr. Ru is the parent element of the 34-hr. Rh. L. J. J.

Migration of ionium under natural conditions.—See A., 1943, I, 74.

Angular relation between two γ -quanta radiated cascade-wise from an atomic nucleus. S. Kikuchi, Y. Watase, and J. Itoh (*Z. Physik*, 1942, 119, 185—187).—Comparison of no. of coincidences in two counters at angular separations 180° and 90° with respect to ^{38}Cl and ^{24}Na γ -sources with the no. of single deflexions in one of the counters shows an angular relation between successive γ -quanta with ^{38}Cl , but not with ^{24}Na . L. J. J.

Multiple scattering of fast electrons. C. W. Sheppard (*Physical Rev.*, 1942, [ii], 62, 313—316).—In view of discrepancies between available data and theory, the multiple scattering of electrons from ^{12}B was studied by Geiger-Müller coincidence counters in Pb and C scatterers (differing by 20% in theoretical scattering power) of equal NTZ^2 , where N = no. of atoms per c.c. of scatterer, T = thickness, and Z = at. no. of scatterer. Comparison of the mean scattering angles showed a ratio nearly that given by the Williams theory. N. M. B.

Scattering of rapid electrons at nuclei. P. Urban (*Z. Physik*, 1942, 119, 67—78).—Re-investigation of the problem on the lines suggested by Mott (cf. A., 1932, 441) brings it into agreement with the results of Sexl (cf. A., 1933, 443). Experimental results are compared with theory. A. J. M.

Elastic scattering of fast positrons by heavy nuclei. H. S. W. Massey (*Proc. Roy. Soc.*, 1942, A, 181, 14—19).—The angular distribution of fast positrons scattered elastically by Hg nuclei is investigated theoretically. The ratio of the scattered intensity to that given by the Rutherford formula is obtained as a function of the angle for positrons of energy from 25,000 to 1.7×10^6 e.v. The ratio is < 1 , decreases with increasing angle of scattering, and is nearly independent of the nuclear charge. It is suggested that experimental investigation of the scattering of fast positrons would help to resolve divergences between experimental and theoretical results for scattering of fast electrons. G. D. P.

Spectrum of cosmic radiation at 2200 m. above sea level. G. Cocconi and V. Tongiorgi (*Naturwiss.*, 1942, 30, 328—329).—Investigation of the absorption of cosmic rays at 2200 m. does not support the presence of bands in the primary mesotron spectrum between 1.7 and 2.7×10^9 e.v., or of the fine structure formerly supposed to be present from observations at different zenith angles. A. J. M.

Variation of cosmic-ray showers with altitude. Photons in the showers. S. Gorodetsky, P. Chanson, and H. Denamur (*Compt. rend.*, 1942, 214, 310—312).—Determinations with various arrangements of counters are reported. Results are discussed in relation to theory and to available data. N. M. B.

Preponderance of positively charged particles in the cosmic-ray spectrum. L. Leprince-Ringuet, E. Nageotte, and M. Lhéritier

(*Compt. rend.*, 1942, 214, 545—547).—Measurements of the energy spectrum at 1000 m. altitude confirm an excess in the ratio 1.35 : 1. Explanations are discussed. N. M. B.

Detection of nuclear disintegration products of cosmic rays with the ionisation chamber. G. Hoffmann (*Z. Physik*, 1942, 119, 35—42).—The formation of ions by cosmic rays has been investigated with a large ionisation chamber. Two types of apparatus are described. The results show the presence of ions from showers, with superimposed effects due to protons and heavy disintegration particles. A. J. M.

Transition effect air-water for heavy particles due to cosmic rays. N. N. Dmitriev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 207—209).—The effect of H_2O layers of various thicknesses on the intensity of isolated heavy particles and fission forks produced by cosmic rays has been investigated. The no. of tracks increases very rapidly at the transition from air to H_2O , and goes on increasing with depth, up to a max. at a depth of ~ 4 m., after which the no. of tracks slowly decreases. The primary radiation produces a secondary radiation with a considerably higher absorption coeff. on passing from air to H_2O . Probably both radiations consist of neutrons. Similar experiments with earth as absorbent show a similar transition effect, though less pronounced. A. J. M.

Transition effects of the soft components of cosmic rays in lead. O. N. Vavilov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 202—206).—The transition effects of the soft component of cosmic rays in Pb were determined at a height of 4200 m., by comparing the ionisation in a chamber when Pb absorbers were placed above and/or below it, with that when the absorbers were absent. The absorption curve in Pb differs from that obtained by previous observers, but resembles more closely the theoretical cascade curves. Experiments were also carried out with Al absorbers. A. J. M.

Connexion between the penetrating non-ionising component of cosmic radiation and penetrating showers. L. Jánosy and G. D. Rochester (*Nature*, 1942, 150, 633).—A new counter investigation, briefly described, indicates that the rate of incidence is $\sim 1\%$ of the rate of ionising radiation observed with a previous arrangement (cf. A., 1942, I, 129), and that $1/3$ of the penetrating showers near sea-level are produced by the penetrating non-ionising radiation. W. J.

Nature of the mesotron. H. Yukawa (*Z. Physik*, 1942, 119, 201—205).—A general theoretical discussion. L. J. J.

Dipole character of mesons and polarisation of vacuum. L. Ivanenko and A. Sokolov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 107—109).—Theoretical. A. J. M.

Direct method for evaluation of the lifetime of the meson. P. V. Auger, R. Maze, and R. Chaminade (*Physical Rev.*, 1942, [ii], 62, 307—308).—The method of delayed impulses from Geiger-Müller counters is applied to the study of meson instability. The decay curve of the mesons at rest can be traced, as in the case of a radioactive element, and an evaluation of the lifetime given. N. M. B.

Non-central forces in the nuclear two-body problem. W. Hepner and R. Peierls (*Proc. Roy. Soc.*, 1942, A, 181, 43—57).—The problem is discussed on the assumption that the range of the forces is small compared with the size of the deuteron, but without sp. assumptions about the forces. The formulae for the electric and magnetic photo-effect in the deuteron remain the same as for central forces, with only minor modifications. The same is found for the scattering of neutrons by protons at energies of a few Mv. or less. G. D. P.

II.—MOLECULAR STRUCTURE.

Molecular spectra of deuterium-hydrogen in the ultra-violet region and isotope effect in the normal state of the deuterium molecule. Y. Fujioka (*Z. Physik*, 1942, 119, 182—184).—Mol. consts. of the $1s1'\Sigma$ state of D_2 are calc. from vibrational and rotational analysis of 32 new bands in the ultra-violet. L. J. J.

Occurrence of carbon isotope bands in spectra of N-type stars. G. Schain (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 90—93).—The position of isotope bands in the different sequences of the Swan and CN bands has been investigated in the spectra of N-type stars. The main and isotopic bands have also been investigated spectrophotometrically. The intensity ratios of the pairs of bands $^{12}\text{C}^{12}\text{C}$ (1—0) : $^{13}\text{C}^{12}\text{C}$ (1—0), $^{12}\text{C}^{12}\text{C}$ (0—1) : $^{13}\text{C}^{12}\text{C}$ (0—1), and $^{12}\text{C}^{12}\text{C}$ (0—2) : $^{13}\text{C}^{12}\text{C}$ (0—2) are nearly equal in the spectrum of a given N-type star. There is an anomaly for the ratio $^{12}\text{C}^{12}\text{C}$: $^{13}\text{C}^{12}\text{C}$ of different sequences. The relative abundance of heavy mols. $^{13}\text{C}^{12}\text{C}$ varies from star to star. A. J. M.

Structure of the band spectrum of phosphorus and nuclear spin. K. N. Rao (*Current Sci.*, 1942, 11, 357).—The band spectrum of P, excited in a discharge tube, has been photographed and the bands (9, 21), (5, 21), (5, 18), and (4, 18) have been measured and, from their rotational structure, the consts. have been evaluated. Quant. measurements on the alternating intensities of rotational structure lines in the first three bands and in the (6, 22) band show that only

the (5. 21) band has an anomalous ratio of 3.3, whilst all the others have 3.6. The nuclear spin is $\frac{1}{2}h/2\pi$. W. R. A.

Band spectrum of bismuth monochloride. S. K. Ray (*Indian J. Physics*, 1942, 16, 35—48).—A no. of new bands of the shorter- λ system (i.e., that between 3600 and 4000 \AA) of BiCl have been measured in emission and absorption, extending the system to $\lambda\lambda$ between 4300 and 5700 \AA . Morgan's analysis of the two band systems of BiCl (A., 1936, I, 267) is confirmed. O. D. S.

Structure of the electronic bands of the OD molecule. IV. Spin doubling. M. G. Sastry (*Indian J. Physics*, 1942, 16, 27—34; cf. A., 1942, I, 223).—Contrary to the view of Johnston (A., 1934, 237) the theory of Hill and Van Vleck (A., 1928, 1076) is found to represent the energy difference between the components of the π -state of the OD mol. with fair accuracy. The spin doublet widths are $>$ those of the OH mol. although the OD mol. is the heavier. This agrees with Hill and Van Vleck's formula. O. D. S.

Complete analysis of absorption spectra. VII. Mutual influence of chromophoric groups in systems with closed π electron groups. E. Hertel and U. Siegel (*Z. physikal. Chem.*, 1942, B, 52, 167—183).—The absorption spectra of a large no. of azo- and other coloured compounds have been measured. When two similar groups are linked through azo- or $-\text{CH}=\text{CH}-$ groups to p -positions of a C_6H_4 nucleus or to 1:5- or 2:7-positions of a C_{10}H_8 nucleus the long- λ absorption region of the chromophoric group is shifted towards longer λ . For 2:7-derivatives of C_{10}H_8 , the formulation of a system of conjugated double bonds between the chromophoric groups is impossible. When different groups are linked to the two azo-groups, however, the absorption of the two groupings is additive. The results are discussed theoretically. The prep. of 1- p -dimethylaminobenzeneazo-5-, m.p. 201—202°, and 4-nitromaphthalene, broad needles or plates, m.p. 181°. 1:5-, dark red needles, m.p. $>300^\circ$, and 1:4-di- p -dimethylaminobenzeneazomaphthalene, rust-brown, m.p. 263°, and 2:7-dibenzylidenenaphthylenediamine, bright yellow needles, m.p. 167—168°, is described. J. W. S.

Absorption spectra of phenylalanine and tyrosine in connexion with the absorption in toluene and p -cresol. (Miss) H. Spomer (*J. Chem. Physics*, 1942, 10, 672—676).—Comparison between the spectra of PhMe and phenylalanine and between those of p -cresol and tyrosine is made, and an interpretation of individual bands is proposed. C. R. H.

Structure of indigoids on the basis of spectral data. N. Dokunichin and E. Levin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 110—113).—The absorption curves of the sulphuric esters of indigo and thioindigo leuco-bases have been investigated. The curves for these substances are very similar, whereas those of the corresponding dyes differ considerably. This is probably due to the existence in the indigo mol. of a weakened internal H bond, which gives rise to the intense colour of the compound. A. J. M.

Ultra-violet absorption spectra of some solid cyanides. F. Gallais (*Compt. rend.*, 1942, 214, 552—553).—The absorption spectra are examined by reflexion from fine powders of the cyanides of K, Hg, Ag, and Cu. The ratio of incident to reflected intensities is plotted against λ and the differences shown are discussed. N. M. B.

Ultra-violet absorption of sulphur compounds. B. Sjöberg (*Z. physikal. Chem.*, 1942, B, 52, 209—221).—The ultra-violet absorption spectra of the following are recorded and discussed: α -monothio-glycerol, γ -chloro- β -hydroxypropylthiol, $\alpha\beta$ - and $\alpha\gamma$ -dithioglycerol; di(isopropylideneglycerol) sulphide, oxytrimethylene sulphide; EtOH solutions of α - and β -acetylchlorohydrin, $\alpha\beta$ -diacetylthio-chlorohydrin, γ -chloro- α -acetylpropylthiol, isopropylidene- α -mono-thioglycerol, -thiochlorohydrin, - β - and - γ -hydroxypropylthiol. W. R. A.

New bands in the ultra-violet absorption spectrum of gelatin. M. Abribat (*Compt. rend.*, 1942, 214, 417—419).—All specimens of gelatin examined show very weak bands at 2600, 2660, and 2700 \AA , with slight inflexions at ~ 2535 and ~ 2790 \AA . These are independent of pH and temp. The same bands appear in the spectrum of ovalbumin, and are attributed to a sterol group. L. J. J.

Ultra-violet absorption of surface anaesthetics.—See A., 1943, III, 140.

Interpretation of vibrational spectra of propane and butane. M. Eliashevitch and B. Stepanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 481—485).—Vibrational frequencies of C_3H_8 and C_4H_{10} , in agreement with experimental infra-red and Raman data, are calc. from force consts. derived from CH_4 and C_2H_6 and their D derivatives. L. J. J.

Fluorescence of solutions and dielectrical properties of solvents. S. Sambursky and G. Wolfsohn (*Physical Rev.*, 1942, [ii], 62, 357—361; cf. A., 1940, I, 192).—Because of different red shifts of the absorption and fluorescence spectrum of anthracene in solution, the longest-wave absorption band is separated from the shortest-wave fluorescence band. This "(0—0) separation" and the red shift are explained as effects of interaction between mols. in the liquid state and are discussed on Onsager's theory of liquids. N. M. B.

Polarisation of fluorescence and law of its decay. L. A. Tumerman (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 474—477).—The temp.-degree of polarisation relation of EtOH solutions of fluorescein, eosin, and rhoduline-orange can be calc. from data obtained with solutions to which a small concn. of KI, sufficient to destroy the initial "dark pause" but insufficient to cause appreciable quenching, has been added. Rhodamine-G extra shows no effect of KI on polarisation, in harmony with the absence of "dark pause" in its fluorescence. L. J. J.

Theory of concentrational depolarization of fluorescence in solutions. S. I. Vavilov and P. P. Feofilov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 34, 220—223).—The relation $1/p' - 1/p = A\epsilon\tau$ (p , p' = degree of polarisation of fluorescence respectively with and without concn. depolarisation; τ = mean life of excited state; ϵ = solute concn.; A const.) is deduced theoretically on the basis of excitation energy transfer by quantum-mechanical resonance. A. J. E. W.

Fluorescence of manganese in glasses and crystals. S. H. Linwood and W. A. Weyl (*J. Opt. Soc. Amer.*, 1942, 32, 443—453).—The use of coloured ions as indicators affording information on the lattice structure of glasses is discussed. In base glasses which favour 6- or 4-co-ordination, respectively, Co^{++} produces a pink or blue colour. Ni gives a yellow colour with 6- and a purple with 4-co-ordination. Comparison of fluorescent Mn glasses with Co glasses having similar bases indicates that Mn is 4-co-ordinate in glasses having green fluorescence, orange or red showing higher co-ordination; this is confirmed by the behaviour of the Mn glasses on heating, and by a marked susceptibility to concn.-quenching in the green-fluorescent glasses. The structure of Zn_2SiO_4 phosphors containing Mn as activator is discussed; the existence of an unstable form of Zn_2SiO_4 with a cristobalite structure is indicated. The effect of lattice imperfections on the fluorescence of Mn is also discussed. A. J. E. W.

Photo-luminescence in liquid and solid solutions of thallium salts. I. I. Kondilenko and A. A. Schischlovski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 163—166).—Dil. aq. solutions of Tl^+ salts have a photoluminescent spectrum with max. at 364, 397, and 430 $\text{m}\mu$. The same structure is shifted to shorter $\lambda\lambda$ in Tl -alkali halide mono-crystals. In aq. solution, increasing $[\text{Cl}^-]$ causes a decrease in intensity of the first, and an increase in that of the second and third, max., so that the spectrum of TlCl in saturated KCl solution resembles that in solid KCl. Increasing $[\text{Br}^-]$ in solution produces a new max. at 470 $\text{m}\mu$. It is concluded that interaction with the Cl^- field deforms the electronic shell of luminescent Tl^+ , whilst with Br^- formation of TlBr_2 gives a new electronic shell. Ultra-violet emission occurs only in spherically-symmetrical fields. L. J. J.

Raman effect. CXXXVI. Nitrogen compounds. XXIV. Alkyl nitrates. H. Wittek (*Z. physikal. Chem.*, 1942, B, 52, 153—166).—Raman frequencies and polarisation data for $\text{MeO}\cdot\text{NO}_2$, $\text{EtO}\cdot\text{NO}_2$, $\text{Pr}^o\cdot\text{NO}_2$, $\text{Pr}^i\cdot\text{NO}_2$, $\text{Bu}^o\cdot\text{NO}_2$, and $\text{Bu}^i\cdot\text{NO}_2$ are recorded. From these results it is inferred that the two N—O linkings of the NO_2 -group are identical, as in EtNO_2 , but the valency angle between them is 10—15° greater. J. W. S.

Raman effect. CXXXVII. Structure of dimeric aluminium trimethyl and trihalides. K. W. F. Kohlrausch and J. Wagner (*Z. physikal. Chem.*, 1942, B, 52, 185—201).—Raman spectra of Al_2Me_6 , NMe_3 , C_2Br_2 , and C_2Cl_4 are reported. The structures of tri-derivatives of Al are discussed; Me and halogen derivatives have probably the same structure. An ethylene-like structure with symmetry D_{2h} is favoured. W. R. A.

Change in Raman spectra of chloroprene and isoprene in the polymerisation process. A. Gantmacher and S. Medvedev (*Acta Physicochim. U.R.S.S.*, 1942, 16, 1—11).—Raman data are given for chloroprene (I), a 30% solution of polymerised (I) in the monomeride, a solution of the polymeride in C_6H_6 or CCl_4 , and the pure polymeride; corresponding data are also given for isoprene (II). In each case polymerisation gives rise to a non-conjugate double-bond line [1660 cm^{-1} in (I) and 1665 cm^{-1} in (II)] not given by the monomeride; a conjugate double-bond line [1630, 1640 cm^{-1}] decreases in intensity as polymerisation proceeds, but remains much stronger than the 1660—1665 cm^{-1} line when $>50\%$ of polymeride is present. The 1020 cm^{-1} C—H line given by (I) is displaced to 1005 cm^{-1} on polymerisation, and its intensity increases considerably. Changes in C—C and C—Cl lines are discussed. Polymerisation does not increase the background intensity of the spectrograms. A. J. E. W.

Raman spectra of betaine. N. A. Slovochotova, J. K. Sirkin, and M. V. Volkenstein (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 146—148).—The Raman spectrum of a 6 mol.-% aq. solution of betaine has been obtained, and compared with that of NH_3 -acids. There is no frequency corresponding to the presence of a $\text{C}=\text{O}$ group. The data agree with the dipole structure of betaine. A. J. M.

Intensity of Raman lines and nature of the chemical bond. M. V. Volkenstein (*Acta Physicochim. U.R.S.S.*, 1942, 16, 120—122).—Comparative intensity data are recorded for characteristic Raman lines of the C—X linkings in EtCl , Bu^oCl , Bu^iBr , Bu^iI , $\text{C}_6\text{H}_5\text{Cl}$, $\text{C}_6\text{H}_5\text{Br}$, $\text{C}_6\text{H}_5\text{I}$, $\text{C}_6\text{H}_5\text{F}$, $\text{C}_6\text{H}_5\text{Cl}_3$, $\text{C}_6\text{H}_5\text{Br}_3$, $\text{C}_6\text{H}_5\text{I}_3$, $\text{C}_6\text{H}_5\text{F}_3$, $\text{C}_6\text{H}_5\text{Cl}_2\text{Br}$, $\text{C}_6\text{H}_5\text{Cl}_2\text{I}$, $\text{C}_6\text{H}_5\text{Br}_2\text{I}$, $\text{C}_6\text{H}_5\text{Br}_2\text{F}$, $\text{C}_6\text{H}_5\text{I}_2\text{F}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}$, $\text{C}_6\text{H}_5\text{F}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{Br}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{Br}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{Br}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{Br}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{Br}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{Br}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{Br}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}$, 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$\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{I}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{Br}$, $\text{C}_6\text{H}_5\text{F}_2\text{Cl}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}$, $\text{C}_6\text{H}_5\text{F}_2\text{Br}_2\text{F}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}_2\text{I}$, 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C_6H_5Cl , and of CO in $AcCl$, $COMe$, $COPhMe$, and $COPh_2$, and of the C_6H_6 ring in C_6H_6 , $PhMe$, $COPhMe$, and $COPh_2$. The correlation of the intensities with structural features of the mols. is briefly discussed. A. J. E. W.

Quantitative molecular spectral analysis. P. Schorin (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 12—25).—The practicability of quant. analysis by measurement of Raman line intensities is discussed, and a theoretical treatment is given of the effect of various factors on the observed line intensities and contours. The light source used should be of const. intensity and afford narrow (2—3 cm^{-1}) exciting lines. The spectrograph slit width should be $\sim 10\text{ }cm^{-1}$. Typical data are given for two seven-component liquid hydrocarbon mixtures and three Grozny petroleum fractions. Intensity standardisation is best effected by adding a reference substance to the liquid under examination. Data are given for the intensity distribution in the Raman spectra of $PhMe$ and methylcyclohexane. A. J. E. W.

Ionisation of gases by collisions of their own accelerated molecules. H. W. Berry (*Physical Rev.*, 1942, [ii], **62**, 378—382; cf. A., 1942, I, 161).—Ionisation of A, N_2 , He, and H_2 by fast neutral atoms in their own gases occurs at 1000—8000 e.v. The efficiencies of ionisation are represented in terms of an approx. cross-section. The vals. of the cross-sections at 5000 e.v. are, respectively, for A, N_2 , H_2 , and He, 1.5, 0.9, 0.2, and 0.05 sq. cm. per c.c. at 1 mm. pressure. In this range A shows a continuously decreasing efficiency with energy of the particle, while H_2 and He show increasing functions. N_2 shows a max. and a min. N. M. B.

Measurement of dielectric constant and loss factor of dielectrics at a wave-length of 14 cm. with hollow resonators. F. Borgnis (*Physikal. Z.*, 1942, **43**, 284—291).— ϵ for a thin rod is deduced from the change in resonance frequency of a hollow cylinder on introducing the rod along its axis. The theory of the method is given, and apparatus (including an oscillator) is briefly described. Loss angles may be determined from the change of shape of the resonance curve. A. J. E. W.

Electrical properties of solids. XIII. Polymethyl acrylate, methacrylate, and α -chloroacrylate, and polychloroethyl methacrylate. D. J. Mead and R. M. Fuoss (*J. Amer. Chem. Soc.*, 1942, **64**, 2389—2393).—The dielectric const. and loss factors of polymethyl acrylate, methacrylate (alone and plasticised with 20 and 30% of CH_2Ph_2), and α -chloroacrylate and polychloroethyl methacrylate have been determined from -70° to 100° and from 60 to 8000 cycles. A correlation between structure and electrical properties for polymerides of the type $(-CH_2-CXY-)_n$ is given. β -Chloroethyl methacrylate, b.p. 170° , was prepared by ester interchange between $CH_2=CHCO_2Me$ and $OH[CH_2]_2Cl$. W. R. A.

Dielectric polarisation of complex compounds of platinum. M. M. Jakschin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 555—557).—The dielectric consts. (ϵ) of 23 cryst. complex Pt compounds at 25° have been determined at 1000 kh. by an immersion method; vals. of ρ_{40}^{25} and n data are also given in some cases. With *cis-trans* isomerides the *trans*-form has the smaller ϵ . ϵ is decreased by increased polarisability of the coordinated groups. Substitution of these groups affects ϵ far more than replacement of the acid groups. Loss of H_2O from $[Pt(NH_3)_4]Cl_2 \cdot H_2O$ reduces ϵ ; such a reduction may be a criterion of zeolitic H_2O . Vals. of the mol. polarisability (P) and $[R]$, and of the ionic coeff. P/P_e (P_e = electronic polarisation), are calc., and the relations between P/P_e and the linking types and configurations in the mols. are discussed. The linkings in *cis*-isomerides appear to be more covalent than those in corresponding *trans*-isomerides. A. J. E. W.

Validity of the Clausius-Mosotti formula. G. B. Brown (*Nature*, 1942, **150**, 661—662).—Only a macroscopic treatment should be applied, and the Clausius-Mosotti formula $(\epsilon - 1)M/(\epsilon + 2)\rho$ for the molar polarisation P should be replaced by $(\epsilon - 1)M/3\rho$, where ϵ , M , and ρ are dielectric const., mol. wt., and density. W. J.

Theory of optical polarisability and natural rotatory power. J. P. Mathieu (*Compt. rend.*, 1942, **214**, 420—421).—The polarisability tensor of a mol. can be resolved into symmetrical and anti-symmetrical tensors, the latter containing only imaginary coeffs. and determining optical activity. For very high or very low frequencies the imaginary coeffs. vanish, leaving a symmetrical tensor. For $\lambda\lambda$ remote from absorption bands, the polarisability of any mol. can be represented by an ellipsoid. L. J. J.

Scattering of light and Kerr constant of spherically symmetrical molecules. T. Neugebauer (*Z. Physik*, 1942, **119**, 114—135).—Mathematical. The scattering of light by asymmetrical mols. is investigated using the rotation Raman effect, and applying quantum mechanics. The connexion between the degree of polarisation and the Kerr effect is obtained. The behaviour of the Voigt part and the polarisation part of the Kerr effect is investigated. The anisotropy due to rotation is negligible. It is shown how the various effects can be distinguished in practice. A. J. M.

Quantum theory of ammonia molecule. M. A. Kovner (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 177—179).—Mathematical. L. J. J.

Intramolecular rotation in simple carbon-carbon linking. S. Mizushima and Y. Morino (*Z. Physik*, 1942, **119**, 188—194).—Raman spectra of dihalogeno-ethers in gas, solution, and solid states show varying proportions of *trans*-form in solution [measured by relative intensities of frequencies 654 and 754 cm^{-1} for $(CH_2Cl)_2$] and 100% *trans*-form in the solids. Dipole moment measurements show a greater rotational hindrance energy coeff. in the gas than in C_7H_{16} or Et_2O solution. CMe_3Et exists in only one form. L. J. J.

Spectroscopic evidence of intramolecular transfer of protons. D. Williams and W. D. Stallcup (*J. Amer. Chem. Soc.*, 1942, **64**, 2684—2686).—Fractionation of a $MeOH-BuOD$ mixture yields $MeOH + MeOD$ and $BuOH + BuOD$ fractions, indicating that intermol. H bonds involve the actual transfer of protons between mols. W. R. A.

Molecular transformations accompanying the Szilard effect.—See A., 1943, I, 47.

Stereochemistry. II. Steric strains as a factor in relative stability of some etherates of boron fluoride. H. C. Brown and R. M. Adams (*J. Amer. Chem. Soc.*, 1942, **64**, 2557—2563).—The prep. and characterisation of BF_3 additive compounds with Me_2O , Et_2O , Pr^i_2O , and tetrahydrofuran (I) are given. The dissociation of these compounds has been studied over a range of temp., and ΔH , ΔG , and ΔS have been obtained. The basic strength of the ethers decreases in the order: (I), Me_2O , Et_2O , Pr^i_2O . The factors generally believed to control base strength do not explain this order but the anomalies may be accounted for by considering the probable steric strains resulting from spatial limitations within the mols. W. R. A.

Constitution and formulation of dimeric compounds of group III elements. B. Eistert (*Z. physikal. Chem.*, 1942, **B**, **52**, 202—208).—The mechanism of dimerisation of Al_2X_6 is discussed; these dimerides appear to have a C_2H_4 structure with the additional two X groups attached to the double linking by a special kind of bond. The intermediate position of Al compounds in the series $MgCl_2$, Al_2Cl_6 , $SiCl_4$ and $MgMe_2$, Al_2Me_6 , and $SiMe_4$ is considered. W. R. A.

Equivalence of chemical bonds of multivalent atoms. A. Pol-esitski, M. Jastschenko, and N. Barantschik (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 83—87).—By using radioactive ^{81}Br as an indicator and measuring the activities of the decomp. products of $CuBr_2$, $AuBr_3$, and PBr_5 prepared from Br which had been subjected to neutron bombardment, it has been shown that the bonds of the multivalent atoms in the bromide mols. are all equiv., as was to be expected from theoretical considerations which are discussed. J. L. E.

Stereochemistry of some metallic complexes, with special reference to their magnetic properties and the Cotton effect. D. P. Mellor (*J. Proc. Roy. Soc. New South Wales*, 1941, **75**, 157—168).—Magnetic moments have been determined for bis-salicylaldehydopropyleneimine-nickel (~ 0), -cobalt (2.48), and -copper (1.76), bis-salicylaldehyde-*o*-phenylenedi-imine-nickel (~ 0), bisformylcamphor-nickel (3.15), -cobalt + $2H_2O$ (5.05), -copper, + dioxan (1.89), bisformylcamphorethylenedi-imine-nickel, + $3H_2O$ (~ 0), -copper, + $2H_2O$ (2.08), and trisformylcamphor-cobalt (1.15). The incidence of the Cotton effect is used to determine the orientation and character of the metal-non-metal linkings as the effect is shown to be absent in ionic complexes. F. R. G.

Stereochemistry of square complexes. D. P. Mellor (*J. Proc. Roy. Soc. New South Wales*, 1942, **76**, 7—46).—A review of the evidence for the square structure of metallic complexes. F. R. G.

Surface tensions, densities, and parachors of aliphatic nitroparaffins. G. E. Boyd and L. E. Copeland (*J. Amer. Chem. Soc.*, 1942, **64**, 2540—2543).—At 25° γ of aliphatic nitroparaffins varies from 35.78 for $MeNO_2$ to 29.20 dynes per cm. for Bu^aNO_2 . The *sec.* isomerides exhibit characteristically lower free surface energies, with Bu^bNO_2 giving 28.65 ergs per sq. cm. The total surface energies of the nitroparaffins at 25.0° vary from 77.11 for $MeNO_2$ to 58.39 ergs per sq. cm. for Bu^aNO_2 . A higher surface energy is shown by the isomerides, with Bu^bNO_2 giving 60.46 ergs per sq. cm. The parachor vals. calc. from the measured γ and ρ are in good agreement with the predictions of Sugden. Vals. of the crit. temp. calc. from the Ramsay-Shields equations are: $MeNO_2$, 623° ; $EtNO_2$, 662° ; Pr^aNO_2 , 675° ; Pr^bNO_2 , 618° ; Bu^aNO_2 , 669° ; and Bu^bNO_2 , $624^\circ K$. W. R. A.

III.—CRYSTAL STRUCTURE.

Quantitative determination of the energy of X-ray reflexions in crystal structure analysis. IV. Further development of methods of micro- and integral-photometering of reflexions. A. Brager and V. Kotov (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 34—42).—The applicability of the method of micro-photometering is extended to a blackening of $S_m \gg 1.0$ by introduction of corrections for systematic errors; the method is developed for use with a microphotometer slit longer than the width of the spot. Data for an intensity scale show the method to be accurate to $\sim 10\%$. The method of integral

photometering is applied to Debye-Hull rings with an accuracy of 10–15%. A consideration of limiting errors involved when the slit size is considerably increased shows that the corrections required are $\geq 100\%$ for $S_m \geq 1.0$. Typical correction curves for microphotometering of spots and powder rings are given. A. J. E. W.

Diffuse scattering of X-rays. L. M. Brechovskich (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 478–480).—Both Zachariasen's and Preston and Bragg's interpretations of diffuse non-Laue max. in X-ray photographs predict their positions correctly, but only the former gives correct vals. for their half-widths. L. J. J.

Crystalline diffusion of X-rays resulting from Bragg reflexions with change of frequency at thermal vibration planes. J. Laval (*Compt. rend.*, 1942, **214**, 431–433).—Mathematical. L. J. J.

Calculation of Debye-Scherrer diagrams of very small crystals by the gas-interference method. H. Boersch (*Z. Physik*, 1942, **119**, 154–163).—The Debye-Ehrenfest interference function for a single rotating mol. is applied to the calculation of intensity distribution in the Debye-Scherrer diagram of cryst. particles containing 1, 2, and 8 unit cells for the case of simple, body-centred, and face-centred cubic lattices. The method gives new max. at low dispersion angles, not present in Bragg reflexions from cryst. planes. L. J. J.

Use of the three-dimensional reciprocal lattice for determination of translation- and space-groups. M. Straumanis (*Z. Krist.*, 1942, **104**, 18–27).—A convenient graphical method for construction of a three-dimensional reciprocal lattice from rotation photographs is outlined. 1–3 photographs are required with orthogonal systems. The space-group is determined from the lattice by comparison of the observed reciprocal period with the theoretical periods for different space-group classes; the final selection depends on the crystal class. Since the method uses positive observations it is preferable to the method of absent reflexions. A. J. E. W.

Peculiarities of Weissenberg photographs of higher layer-lines. F. Halla (*Z. Krist.*, 1942, **104**, 44–46).—The formation of the Weissenberg photograph of the pseudo-equator is considered, and it is shown that the "optical" reflexion curve does not coincide with the line representing conjunction of X-ray reflexions and counter-reflexions. Divergent "tails" in the X-radiogram are thus explained. A. J. E. W.

Comparison of X-ray line breadth and internal friction for α -brass as affected by cold-working and annealing. F. Niemann and S. T. Stephenson (*Physical Rev.*, 1942, [ii], **62**, 330–333).—X-Ray line breadth measurements for samples of α -brass cold-stretched to different extents and then annealed at various temp. differ markedly from internal friction measurements on the same samples. For small amounts of cold-work, line breadths appear to be affected by the rate of cold-working, whereas internal friction seems more dependent on the amount of cold-work. The internal friction introduced by cold-work is removed by low-temp. annealing. Line breadth changes little with annealing until just before recrystallisation, when it shows a fairly sharp decrease. N. M. B.

Ionic radii and the periodic system. II. Calculation of ionic radii from physical atomic data. E. Kordes (*Z. physikal. Chem.*, 1940, **B**, **48**, 91–107).—Ionic radii agreeing with known vals. are calc. from a formula based on the Bohr at. model, taking into account the screening effect of d - and s -electrons. This effect is approx. const. for each period (beginning with an inert gas or Cu, Ag, or Au). Max. and lower valencies are covered by the method. L. J. J.

Tabulated diffraction data for cubic isomorphs. L. K. Frevel (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 687–693).—Representative diffraction patterns of 33 cubic crystal structures designated as in the "Strukturbericht" are represented diagrammatically. Structures having comparable powder patterns are tabulated. Lattice consts. for 705 cubic substances are given. The data indicate possible ambiguities of a chemical analysis by diffraction methods. L. S. T.

Structure of graphite. H. Lipson and A. R. Stokes (*Proc. Roy. Soc.*, 1942, **A**, **181**, 101–105).—To account for the presence of extra lines on X-ray powder photographs a new structure is proposed. It has hexagonal layers similar to those of graphite, but arranged in a different sequence. About 14% of the new structure is present in the specimens examined. G. D. P.

X-Ray determination of unit cell of $K_3Co(CN)_6$ crystals. V. Barchatov and H. Shdanov (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 43–58).— $K_3Co(CN)_6$ is pseudorhombic, with the apparent cell dimensions a 13.6, b 10.4, c 8.4 Å; V 1202 cu. Å; ρ_{obs} 1.9; 4 mols. per unit cell; space-group D_{2h}^{17} . The true cell contains 2 mols. and has a 7.1, b 10.4, c 8.4 Å, β 107° 20'; V 600 cu. Å; space-group C_{2h}^2 . The unit cells given by Gottfried *et al.* for compounds of the type $K_3M^{III}(CN)_6$ (cf. A., 1931, 27; 1933, 215) are incorrect. A. J. E. W.

X-Ray examination of the structure of $K_3Co(CN)_6$. V. Barchatov (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 123–124; cf. preceding abstract).—The Co and K parameters are deduced by consideration of the pseudorhombic symmetry of the crystal, and by one-dimensional Patterson analyses based on visually-estimated intensities.

The CN' positions are found by assuming the configuration of the $Co(CN)_6'''$ group and determining its orientation from intensities and space-filling conditions. K' ions are of two types, surrounded by 6 CN' arranged octahedrally or in a trigonal prismatic configuration, respectively; each CN' adjoins 3 K' and 1 Co''' . The M^{III} atom positions in structures of compounds of the type $K_3M^{III}(CN)_6$ deduced by Gottfried *et al.* are incorrect. A. J. E. W.

X-Ray examination of d -pyramic acid, $C_{20}H_{30}O_2$. N. Sevastianov and H. Shdanov (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 59–62).— d -Pyramic acid has a 20.67, b 10.76, c 7.76 Å; ρ_{obs} 1.13; 4 mols. per cell; space-group $D_{2h}^3-P2_12_12$. A. J. E. W.

Crystal structure of β -glycylglycine. E. W. Hughes and W. J. Moore (*J. Amer. Chem. Soc.*, 1942, **64**, 2236–2237).—This is compatible only with the structure shown, the mol. being held together by H–O linkings. The terminal N is surrounded by three O (two CO_2H , one CO); the N–H linkings are tetrahedral within 10°. The NH forms a H–O linking with a neighbouring CO. The unit cell contains 8 mols. and has a 17.89, b 4.62, c 17.06 Å, β 125° 10'. The space-group is $A2/a$ (or Aa) (cf. Bernal, A., 1931, 1002). R. S. C.

Macromolecular disorder in linear polyamides. Relation of structure to physical properties of copolyamides. W. O. Baker and C. S. Fuller (*J. Amer. Chem. Soc.*, 1942, **64**, 2399–2407).—31 linear polyamides and copolyamides of varying cryst. structures and concn. of polar linkings along the chains have been investigated as fibres and as polycryst. sections by X-ray diffraction. Elastic moduli and moisture sorption have been determined for typical samples ranging from soft to porcelain-like polymers. Polar linkings which join the paraffin sections of the base units together in the long chains associate in adjacent macromols. to form H-bonded dipole layers, and this interaction governs the physical properties and leads to an interpretation of m.p., hardness, elastic modulus, and moisture sorption in terms of the concn., separation, population, and perfection of the dipole layers. Copolymerisation introduces disorder and causes softening and unexpected variation of X-ray identity periods along the chains. Macromol. solids containing some cryst. regularity may be treated as defect systems in which the position and organisation of interacting polar groups govern physical properties. W. R. A.

Structure of boron hydrides. M. E. Diatkina and J. K. Sirkin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 180–183).—Electron diffraction intensity curves of B_2H_6 , calc. for the author's model (A., 1941, I, 401), compared with Bauer's data (A., 1937, I, 397), agree as well as do those given by Bauer's C_2H_6 -like model for the mol. dimensions 1.80 ± 0.04 , 1.23 ± 0.03 , and 1.33 ± 0.03 Å. for B–B, B–H_{ext.}, and B–H_{int.}, and the angles $125 \pm 8^\circ$ and $95 \pm 5^\circ$ for $HBH_{ext.}$ and $HBH_{int.}$, respectively. L. J. J.

Structures of boron dimethyl fluoride and boron methyl difluoride. S. H. Bauer and J. M. Hastings (*J. Amer. Chem. Soc.*, 1942, **64**, 2686–2691).—From electron diffraction measurements BMe_2F and $BMeF_2$ are planar. In BMe_2F B–F = 1.29 ± 0.02 ; B–C = 1.55 ± 0.02 ; C–F = 2.48 ± 0.03 Å; in $BMeF_2$ B–F = 1.30 ± 0.02 ; B–C = 1.60 ± 0.03 ; C–F = 2.53 ± 0.03 Å. W. R. A.

Structure of diphenylene.—See A., 1943, II, 58.

Constitution of perylene. Electron diffraction investigation. R. Spurr and V. Schoumaker (*J. Amer. Chem. Soc.*, 1942, **64**, 2693–2696).—Electron diffraction measurements on perylene indicate that it is α -methyl- β -vinylacetylene. Structural parameters have been found. An approximation to the radial distribution integral is described. W. R. A.

Hall effect and conductivity of cuprous oxide. S. J. Angello (*Physical Rev.*, 1942, [ii], **62**, 371–377).—Measurements show that the exponential law of temp.-dependence is not obeyed and that the divergence is caused by a loss of conduction holes with time and an anomalous decrease in the mean free path at $\sim 100^\circ$. An experiment is described which indicates that the rate of ageing at 100° is increased by the application of an electric field. N. M. B.

Contacts between metals and between a metal and a semiconductor. H. Y. Fan (*Physical Rev.*, 1942, [ii], **62**, 388–394; cf. A., 1942, I, 229).—Mathematical. The problem is treated classically with the help of the results of wave-mechanical theory of electron energy states in solids. The potential and electron density distributions in the two bodies near the contact are discussed. The problem of a body in vac. and of two bodies separated by a gap is discussed qualitatively. N. M. B.

Theory of anomalous reflexion of atomic rays at crystal surfaces. II. Calculation of the form of trough for discontinuous potential curves. K. Artmann (*Z. Physik*, 1942, **118**, 659–676; cf. *ibid.*, 624).—Theoretical. Using a crystal model with a discontinuous potential curve, theory leads to positions of troughs in agreement with Stern's experiment, but there are considerable differences between the form of the trough indicated by theory and experiment. A. J. M.

Theory of anomalous reflexion of atomic rays at crystal surfaces. **III. Transition to continuous potential curve.** K. Artmann (*Z. Physik*, 1942, **119**, 49—66; cf. preceding abstract).—Mathematical. With a continuous potential curve the position of troughs remains the same, but the form does not agree in detail with the observations of Stern. A. J. M.

Theory of anomalous reflexion of atomic rays at crystal surfaces. **IV. Consideration of energy exchange between lattice and particles.** K. Artmann (*Z. Physik*, 1942, **119**, 137—153; cf. preceding abstract).—Mathematical. Theoretical and observed reflexion distributions of He atoms at cryst. surfaces agree when energy exchange with vibrating lattice atoms is taken into account. L. J. J.

Behaviour of non-polar crystals just below the m.p. and at the m.p. I. N. Stranski (*Z. Physik*, 1942, **119**, 22—34).—Equilibria at the surfaces of non-polar crystals are discussed. It is supposed that the loosely bound structural units at the surface of a crystal undergo a change corresponding to melting at a temp. below the m.p. The appearance of new surfaces under these conditions is discussed. Small crystals must in general have a higher m.p. than a large cryst. mass. The theory is compared with experiment on certain metallic crystals. A. J. M.

Melting process in non-polar crystals. I. N. Stranski (*Naturwiss.*, 1942, **30**, 425—433).—A lecture in which recent work is summarised and theories are discussed. C. R. H.

Elastic constants of crystals from X-ray studies of thermal agitation of atoms. J. Laval (*Compt. rend.*, 1942, **214**, 623—625).—Mathematical. L. J. J.

Elastic constants of β -quartz. E. W. Kammer and J. V. Atanasoff (*Physical Rev.*, 1942, [ii], **62**, 395—400; cf. A., 1941, I, 105).—A new method for quickly locating and measuring weak resonance points of a plate of piezoelectric material is described and applied with a dynamical method to determine all elastic const. of β -quartz. Vals. obtained and all available data are tabulated. N. M. B.

Active substances. LVI. Allotropic change of finely divided metals on carriers. R. Fricke and H. Müller (*Naturwiss.*, 1942, **30**, 439—440).—The α -Co- β -Co transformation is discussed. $\text{Co}_2\text{O}_3 \cdot \text{H}_2\text{O}$ or $\text{Co}(\text{OH})_2$ mixed with co-pptd. $\text{Al}(\text{OH})_3$ was reduced by H_2 at various temp. (300—870°). When reduced above $\sim 450^\circ$ and cooled to room temp. the cubic (β) structure always resulted. At all reduction temp. the product from $\text{Co}(\text{OH})_2 + \text{Al}(\text{OH})_3$ was spontaneously pyrophoric, but that from $\text{Co}_2\text{O}_3 \cdot \text{H}_2\text{O}$ was spontaneously pyrophoric only for reduction temp. $< \sim 400^\circ$. The cubic β -Co from $\text{Co}_2\text{O}_3 \cdot \text{H}_2\text{O}$ was partly transformed into α -Co when rubbed in a mortar, but the β -Co- Al_2O_3 was unchanged after rubbing. C. R. H.

Nature of low-temperature transformation of ND_4I . A. Smits and D. Tollenaar (*Z. physikal. Chem.*, 1942, **B**, **52**, 222—229).—The low-temp. transformation of ND_4I , investigated dilatometrically, is continuous; the vol. effect is $\sim 6\%$ $>$ that in NH_4I ; the min. and the max. V , respectively, are 3.9° and 2.8° lower than in NH_4I . The V - T line in ND_4I is displaced to lower temp. as compared with NH_4I and has a steeper slope. The mol. vols. of NH_4Br , NH_4I , ND_4Br , and ND_4I have been determined by X-ray methods. W. R. A.

Pseudocomponents of ammonium halides. A. Smits (*Z. physikal. Chem.*, 1942, **B**, **52**, 230—233).—Postulation of the simultaneous existence of two components in equilibrium in the NH_4 halides is considered to be premature. W. R. A.

IV.—PHYSICAL PROPERTIES OF PURE SUBSTANCES.

Determination of the mol. wt. of cellulose by an end-group method.—See A., 1943, II, 58.

Electrical properties of lead sulphide. H. Hintenberger (*Z. Physik*, 1942, **119**, 1—21).—The conductivity and its variation with temp., the thermo-electric power, and the Hall const. of PbS have been investigated in order to discover how these properties vary with changes in the stoichiometric composition of the PbS. The conductivity of pure PbS is increased when there is an increase of either Pb or S. The thermo-electric power varies between 700 and $-500 \mu\text{V}$. per degree, and the Hall const. between 156 and $-23 \text{ c.c. per coulomb}$. Treatment of PbS in a vac., thereby leading to removal of S, gives negative vals. With excess of S the vals. are positive. In the first case there is excess semi-conduction, in the second there is defect semi-conduction. The temp. coeff. of conductivity is largely dependent on the stoichiometric composition of the PbS. A. J. M.

Temperature-dependence of resistance of electrical conductors and semi-conductors. H. Voelkner (*Z. tech. Physik*, 1942, **23**, 100—103).—The dependence of the electrical resistance of W and glowing C filaments on temp. is discussed. W. R. A.

Superconductivity. M. von Laue (*Physikal. Z.*, 1942, **43**, 274—284).—A review and theoretical discussion of superconductivity and related topics, including free energy of order, change of direction of

current flow and diamagnetism in superconductors, thermodynamics of superconductivity, and the intermediate state. A. J. E. W.

Theory of superconductivity. K. Ariyama (*Z. Physik*, 1942, **119**, 174—181).—The application of Welker's magnetic interaction relations (A., 1939, I, 132) to the Bloch-Hartree electronic model for metals gives a qual. explanation of superconductivity. L. J. J.

Superconductivity. II. Evaporated lead films. W. F. Brucksch, jun., and W. T. Ziegler. **III. Tin, niobium, tantalum, and lead wires.** W. T. Ziegler, W. F. Brucksch, jun., and J. W. Hickman (*Physical Rev.*, 1942, [ii], **62**, 348—353, 354—356; cf. A., 1942, I, 377).—II. Electrical and magnetic properties of evaporated Pb films of thicknesses 1000—3000 Å. were studied in the superconducting state. The films show transition temp. (in zero magnetic field) of $7.23 \pm 0.03^\circ \text{K}$., irrespective of thickness. The disappearance of resistance usually occurs within a range of 0.10° . The depression of the transition temp. T_c with increase in measuring current I_c is the greater the thinner is the film. The depression of T_c in magnetic fields of 0—80 oersteds perpendicular to the plane of the film depends on thickness, the thinner films requiring larger external fields to produce unit depression. I_c - T_c curves show new inflexion points, and these are supported by the H_c - T_c curves.

III. Corresponding properties of wires 25—250 μ . in diameter were investigated. Results show that a low resistance ratio R/R_0 (R_0 = room-temp. resistance), high T_c , and small transition range are always found together for a given metal. Pb wires of different thicknesses all gave $T_c = 7.20 \pm 0.01^\circ \text{K}$., a fact attributed to the similar cryst. character of the wires. N. M. B.

Superconductivity of liquid helium II. J. G. Daunt and K. Mendelssohn (*Nature*, 1942, **150**, 604; cf. A., 1939, I, 362, 410).—The theoretical interpretations of the superconductive state and the λ -phenomenon in liquid He II should be fundamentally similar. There is a striking analogy, not merely a superficial similarity, between the two, and this supports the hypothesis (i) that the transfer film of liquid He II extends to all solid surfaces not only above the liquid level but also below it, (ii) that the anomalous transport phenomena (high thermal conductivity, low η , and fountain effect) take place in this film, and (iii) that the λ -phenomenon is due to the existence of He atoms of very low (or zero) thermal energy separated to a certain extent from the bulk liquid, as indicated by the mechano-caloric effect. W. J.

Thermomagnetic properties of magnesium, silver, and lithium. S. R. Rao and (Miss) K. Savithri (*Proc. Indian Acad. Sci.*, 1942, **16**, A, 207—220).—Vals. of χ (Curie method) at different temp. from 30° to 270° are given. $\chi_{\text{Mg}}^{30^\circ} = 1.08 \times 10^{-6}$ and decreases as temp. is raised in a manner similar to rare-earth elements. $\chi_{\text{Li}}^{30^\circ} = 2.5 \times 10^{-6}$ and increases slowly and slightly until the m.p. is reached, when there is a fall of $\sim 0.15 \times 10^{-6}$. $d\chi/d\theta$ agrees with Stoner's theory. The g-at. susceptibility of Ag is -19.9×10^{-6} , giving 5.1 v. for the width of the energy band of the free electrons, in good agreement with the calc. val. for max. Fermi energy. The valency electron in Ag approximates very closely to the ideal condition of a free electron. W. R. A.

Magnetic susceptibility of peroxides. (Miss) K. Savithri and S. R. Rao (*Proc. Indian Acad. Sci.*, 1942, **16**, A, 221—230).—Vals. of χ for aq. H_2O_2 (at $> 32\%$ H_2O_2) and for Na_2O_2 and BaO_2 have been determined and the mol. structures are discussed. H_2O_2 consists of two tautomeric forms, the relative amounts of each depending on $[\text{H}_2\text{O}_2]$. In Na_2O_2 and BaO_2 the O is linked to the metal by a single linking. W. R. A.

Dispersion of high-frequency acoustic waves in liquids. V. L. Ginzburg (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **36**, 8—13).—Possible mechanisms are considered, to account for the decrease in acoustic velocity with increase in frequency (negative dispersion). F. R. G.

Reflectivities of aluminium and silver films. M. V. S. Ramakrishnan (*Indian J. Physics*, 1942, **16**, 12—22).—The reflectivity of evaporated Al films has been compared with that of chemically deposited and sputtered Ag mirrors. The reflectivity of Ag mirrors is improved by polishing but deteriorates rapidly with the tarnishing of the film. Al films have lower reflectivity than Ag films in the infra-red and visible regions but their reflectivity is the higher in the ultra-violet. The reflectivity of Al throughout the region 4000—7000 Å. is const. at 90%. Al films do not tarnish. O. D. S.

Relation of the Debye theory and the lattice theory of specific heats. M. Blackman (*Proc. Roy. Soc.*, 1942, **A**, **181**, 58—67).—In the Debye theory of sp. heat of solids the val. of θ calc. from the elastic const. should be the same as that found from sp. heat data. The ratio of these vals. of θ is calc. from lattice theory and is found to be very nearly unity for NaCl lattices provided that the crystals are not very anisotropic. For other crystal types the val. unity occurs only in isolated cases. G. D. P.

Specific heats and latent heats of fusion and transition of the condensed gases CD_4 and CH_3D . K. Clusius and L. Popp (*Z. physikal. Chem.*, 1940, **B**, **46**, 63—81).—A H_2 liquefaction apparatus which

includes facilities for determining thermal changes at $\pm 10^\circ \text{K}$. is described. The vol. of the calorimeter is 3 c.c., thereby permitting the use of only 0.06 g.-mol. of gas. The prep. of pure CD_4 from D_2 and CO_2 and of MeD from MgMeI and D_2O is described. The triple-point pressures, m.p., mol. latent heats of fusion, transition points, and sp. heats at various temp. of solid and liquid CD_4 and MeD are recorded and compared with corresponding data for CH_4 . Besides the two forms corresponding to the solid forms of CH_4 , solid CD_4 and MeD also exist in a third low-temp., double refracting form. J. W. S.

Linear speed of crystallisation of potassium, sodium, and lithium disilicates. A. Leonteva (*Acta Physicochim. U.R.S.S.*, 1942, 16, 97—101; cf. A., 1941, I, 331, 408).—Crystallisation speed-temp. curves for the compounds $\text{M}_2\text{O} \cdot 2\text{SiO}_2$ ($\text{M} = \text{Na}, \text{K}, \text{Li}$) are given; max. occur at 762° , 930° , and 760° , respectively. The relation of crystallisation to viscosity is discussed. A. J. E. W.

Density of selenium. A. N. Campbell and S. Epstein (*J. Amer. Chem. Soc.*, 1942, 64, 2679—2680).— ρ of metallic and liquid Se have been measured from 20° to 277° . The measurements give no indication of a shifting internal equilibrium, and agree with the conclusions of Dobinski *et al.* (A., 1937, I, 175). The rise of m.p. with pressure has been calc. W. R. A.

Representation of vapour pressures. J. P. E. Duclaux (*Compt. rend.*, 1942, 214, 619—621).—Data for H_2O are in better agreement with the author's formula (cf. A., 1942, I, 357) than with the Dupré formula $\log P = -A/T + B + C \log T + DT + \dots$ L. J. J.

Mathematical correlation of the paraffins. P. Buthod, L. Rowell, E. Stewart, jun., and W. S. Foster (*Oil and Gas J.*, 1942, 41, No. 21, 38).—For the lighter paraffins the v.p. (P) may be calc. from the equation $\log P = 0.08522n + 5.18573 + 853.4n^{0.6825}/\theta$, where P is lb. per sq. in. abs.; n = no. of C atoms in the mol.; θ = temp. $^\circ\text{F}$. abs. J. W.

Critical pressure from b.p. and parachor data. M. S. Telang (*J. Indian Chem. Soc.*, 1942, 19, 366—368).—The crit. pressure (P_c) can be obtained from the formula $P_c = k \cdot T_b/[P]$, where T_b is the abs. b.p. at 760 mm. and $[P]$ is the parachor. If P_c is in cm. k has a mean val. of 1952 for 25 non-associating liquids, for which the agreement between calc. and observed vals. of P_c is fairly good. F. L. U.

Liquid state. (Sir) C. V. Raman (*Current Sci.*, 1942, 11, 303—310).—A review. W. R. A.

Tensile stress of water and liquid structure theory. R. S. Silver (*Nature*, 1942, 150, 605).—Consideration of Fürth's hole theory suggests that the liquid should maintain a tensile stress up to the limit corresponding to the hydrostatic pressure p^* , but that owing to the disturbing influence of evaporation nuclei (particles and dissolved gases) the actual limit may be much less, and in water negligible. A tensile stress above the limit imposed by the nuclei may, however, persist for a short time, the val. attained depending on the relative times for the evaporation and for the growth of the stress. The ultimate limit corresponding to p^* could be maintained for an infinitesimal time and transmitted as a tensile wave. In H_2O a very steep tensile wave-front would be expected, and observations of explosion waves and erosive action afford evidence of the transmission of such a wave, several hundred kg. per sq. cm. W. J.

Failure of elastic-viscous material in the process of relaxation. G. M. Ivanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 142—145).—Theoretical. The relaxation process in an elastic-viscous material in which elastic deformation, plastic flow, and rate of plastic flow are finite is discussed. A. J. M.

V.—SOLUTIONS AND MIXTURES (INCLUDING COLLOIDS).

Thermal diffusion of radon-gas mixtures. G. E. Harrison (*Proc. Roy Soc.*, 1942, A, 181, 93—100; cf. A., 1937, I, 558).—Thermal diffusion of Rn-Ne and Rn-A mixtures has been studied. Vals. for the force field between dissimilar mols. are deduced. The results show that Rn is the "softest" of the inert gas mols. G. D. P.

Partial pressures. E. C. Craven (*Chem. and Ind.*, 1943, 27—28).—Difficulties in the practical interpretation of Dalton's law are noted. For most indifferent gases Amagat's additive vol. law is more nearly true. Where combination or increased mol. attraction occurs the total vol. will increase, and vice versa. F. L. U.

Physical effects of substances highly diluted according to a power law. K. Wintersberger (*Naturwiss.*, 1942, 30, 330).—The special properties of solutions diluted according to a power law (cf. Heintz, A., 1942, I, 393) are doubted. Impurities from the conductivity vessel might account for the variation in conductivity. The effect of light on the conductivity of EtOH , and the use of platinised Pt electrodes with alcoholic solutions, are also possible sources of error. A. J. M.

Very dilute liquid mixtures. H. Harms (*Z. physikal. Chem.*, 1940, B, 46, 82—104).—The densities of dil. solutions of MeOH and EtOH in cyclohexane, C_6H_{14} , and CCl_4 have been measured by the float method. The departures from vol. additivity are deduced and are compared with the heats of mixing of the liquids at these concns. From measurements of the heats of evaporation and of mixing, the energies of solvation of the solute mols. and the energy of transference of the solute mols. from the solution to the vapour state are deduced. J. W. S.

Light yield of photoluminescence of aqueous solutions of thallous salts. I. I. Kondilenko and A. A. Schischlovski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 236—240).—The abs. energy yield of photoluminescence of aq. TlCl (5×10^{-5} g. per c.c.) drops from 36.0% ($\equiv 61.7\%$ quantum yield) in absence of added chloride to 18.3% ($\equiv 31.5\%$ quantum yield) in presence of 2.5M- KCl . EtOH has a strong quenching action. The calc. mean period of the excited state of the hydrated Tl^+ ion $= 1.14 \times 10^{-8}$ sec., the val. usual for spontaneous radiation. C. R. H.

Dipole swarm formation in solution. H. Hartmann (*Z. physikal. Chem.*, 1942, B, 51, 309—318).—Mathematical. Swarm formation of polar mols. in non-polar solvents has been calc. and the vals. have been used to derive thermodynamic properties of the solutions in qual. agreement with experimental data. The possibility of distinguishing experimentally between swarm and association theories is discussed. W. R. A.

Osmotic pressure and diffusion. R. Lucas (*Compt. rend.*, 1942, 214, 536—538).—Mathematical. From the osmotic pressure wave expression (A., 1942, I, 393), the osmotic pressure is evaluated with the help of experimental data. Results show the conditions under which solutions are normal and those under which they deviate from van't Hoff's law. N. M. B.

Propagation of ultrasonic waves in liquid mixtures and inter-molecular forces. II. R. Prasad (*Indian J. Physics*, 1942, 16, 1—11; cf. A., 1942, I, 201).—The compressibility-concn. curves for mixtures of EtOH and C_6H_6 and of C_6H_6 and Et_2O have been determined. These results and those of previous workers for C_7H_{16} - BuOH , C_6H_6 - CCl_4 , and EtOAc-CCl_4 mixtures are interpreted qualitatively on a theory of mol. force fields. O. D. S.

Theory of concentrational quenching of fluorescence in solutions. S. I. Vavilov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 100—106).—Theories of concentrational quenching of fluorescence are reviewed and a new one is developed. The probability of there being no quenching during a certain interval of time for a given concn. for a mol. that has absorbed one quantum is computed, and in a similar way, the chance of there being no transfer of energy under the same conditions is obtained. A law is obtained for the decay of fluorescence in the case of concentrational quenching. It is in satisfactory agreement with experimental results with fluorescein, rhodamine-B, and eosin in glycerol. A. J. M.

Cryoscopic and viscosity studies of polyisobutylene. Cryoscopic deviation of polyisobutylene solutions from Raoult's law. A. R. Kemp and H. Peters (*Ind. Eng. Chem.*, 1942, 34, 1192—1199).—The val. of K_{em} in the mol. wt.- η equation $M = (\log \eta_r \times K_{em})/C$ for polyisobutylene in $n\text{-C}_6\text{H}_{14}$ increases from 0.60×10^4 for the trimeride to a const. val. of 0.75×10^4 at mol. wt. 1000; above 2300 negative deviations from Raoult's law are observed. Extrapolation of cryoscopic data from non-ideal solutions to infinite dilution gives inordinately high mol. wt. vals. compared with those based on f.p. measurements of ideal solutions. For mol. wt.- η measurements $n\text{-C}_6\text{H}_{14}$ is the best solvent; C_6H_6 behaves anomalously. A slight decrease in η on shaking $n\text{-C}_6\text{H}_{14}$ solutions of polymerides of mol. wt. 10^5 and greater was observed. Fractionation of polymerides may be effected by diffusion of $n\text{-C}_6\text{H}_{14}$ solutions into a mixture of $n\text{-C}_6\text{H}_{14}$ and COMe_2 . D. F. R.

Viscosity of dilute solutions of long-chain molecules. IV. Dependence on concentration. M. L. Huggins (*J. Amer. Chem. Soc.*, 1942, 64, 2716—2718).—Modification of previous theoretical treatment of η of dil. solutions of long-chain mols. (cf. A., 1939, I, 318) yields an equation for the initial concn.-dependence of η identical with that proposed empirically by Schulz and Blaschke (A., 1942, I, 364). The form of the equation at low concns. is discussed and compared with existing equations. W. R. A.

Magnetic studies of colour changes in cupric chloride. N. A. Yajnik, R. Chand, A. N. Kapur, and D. C. Jain (*J. Indian Chem. Soc.*, 1942, 19, 357—362).—The variation of magnetic susceptibility (χ) with concn. was measured for solutions of CuCl_2 in H_2O , MeOH , EtOH , Pr^nOH , and Bu^nOH . In H_2O , Pr^nOH , and Bu^nOH the curves are made up of two straight lines meeting at an angle which corresponds with a sharp colour change (blue-green), whilst in MeOH and EtOH the change of χ is represented by a single straight line, and the solutions are green at all concns. between 1.3 and 32% (MeOH) and between 2.4 and 13% (EtOH). The results are regarded as consistent with the theory that the colour change is due to the formation or dissociation of complex ions, but not with that which attributes the change to solvation. F. L. U.

Partial molal volumes of nickel sulphate solutions. R. W. Gelbach and H. M. Louderback (*J. Amer. Chem. Soc.*, 1942, **64**, 2379).—At 25° the aq. solubility of NiSO_4 is 28.42 g. per 100 g. of solution. Vals. of p^{28} have been determined for aq. NiSO_4 (0.0634 to 2.525M.). The partial molal vols. conform to the Debye-Hückel limiting law.

W. R. A.

System aluminium-zinc. O. Tiedemann (*Z. physikal. Chem.*, 1942, **A**, 191, 133—144; cf. B., 1926, 160, 751).—Recent work by Röhrig and Rock (*Metallwirts.*, 1941, **20**, 383) and Feldmann (*ibid.*, 501) is discussed and shown to support the existence of a metastable region of Al-Zn alloys with <29% Zn.

F. L. U.

Composition-thermostability diagram of the ternary solid solution of iron-chromium-aluminium alloys. I. Kornilov and R. Minz (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 78—82).—The relation of the thermostability of the system Fe-Cr-Al to its composition has been studied by measuring the rate of loss of wt. per unit surface when alloys of varying composition were held at 1100°, 1200°, 1300°, and 1400° for 240 hr. The results were the same at all four temp. and the rate of oxidation was decreased by increased amounts of Cr and Al. Curves of const. loss of wt. in the Fe-Cr-Al system are reproduced; at a Cr content of 15—20% they almost become straight lines parallel to the Fe-Cr binary system.

J. L. E.

Chromium-silicon system. N. N. Kurnakov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 110—113; cf. A., 1940, I, 291).—Thermal analysis data, and data on hardness and temp. coeff. of electrical resistivity, are recorded; they indicate the existence of Cr_3Si , Cr_2Si , Cr_3Si_2 , CrSi , and CrSi_2 , which is also supported by the microstructure of cast and annealed alloys.

L. S. T.

System chromium-silicon-iron in the region of silicochrome. N. N. Kurnakov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 158—159).—Sections of the ternary system Cr-Si-Fe are shown for 15 and 25% Fe and a tentative ternary diagram for alloys with >25% Si. The silicides $(\text{Cr},\text{Fe})\text{Si}$ and $(\text{Cr},\text{Fe})\text{Si}_2$ form a eutectic system, as also does the latter with Si.

A. R. P.

Solubilities of weak acids in salts of weak acids. W. V. Bhagwat, M. Varma, and H. G. Hermalkar (*J. Indian Chem. Soc.*, 1942, **19**, 363—365).—Solubilities of BzOH and of $o\text{-OH}\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{H}$ in solutions of K salts of various weak acids have been determined (vals. not given), and the solubility-concn. curves are discussed.

F. L. U.

Solubility maximum of boric oxide in concentrated nitric acid. F. Trombe (*Compt. rend.*, 1942, **214**, 488—490).—Solubility (S) data for B_2O_3 in HNO_3 (0—100%) at 30° are recorded in triangular diagrammatic form. S has a min. val. of 0.6% in 30% HNO_3 and a max. val. of 25% in 91% HNO_3 . S decreases rapidly as $[\text{HNO}_3]$ increases above 94%, the ratio $\text{B}_2\text{O}_3/\text{H}_2\text{O}$ remaining const. and ~ 1 .

C. R. H.

Solubility relations of mercuric oxide in aqueous solutions of hydrogen chloride. A. B. Garrett and J. Lemlet (*J. Amer. Chem. Soc.*, 1942, **64**, 2380—2383).—In dil. HCl the solubility curve for HgO shows a break due to formation of a new solid phase, $2\text{HgO}\cdot\text{HgCl}_2$ (I), but the exact val. of $[\text{HCl}]$ at the transition point has not been determined. (I) has solubility of 11.4×10^{-4} mol. per 1000 g. of H_2O . The relative distribution of dissolved Hg among $\text{Hg}(\text{OH})\text{Cl}$, HgCl_2 , HgCl^+ , and HgCl_3^- is discussed.

W. R. A.

Solubility of strontium chromate and the detection of strontium.—See A., 1943, I, 42.

Solubility of potassium and zinc iodates in dioxan-water mixtures. Effect of sorting of solvent molecules. J. E. Ricci and G. J. Messe (*J. Amer. Chem. Soc.*, 1942, **64**, 2305—2311).—Solubilities of KIO_3 and $\text{Zn}(\text{IO}_3)_2$ at 25° have been determined in H_2O -dioxan (0—100 wt.-%) mixtures and agree with the empirical rule of the constancy of the activity coeff. of electrolytes at saturation (A., 1940, I, 207). Agreement between observed and calc. vals. is satisfactory. The results are used to test modified equations of Born and Debye.

W. R. A.

Solubilities of orthanilamide, metanilamide, and sulphanilamide. R. H. Kienle and J. M. Sayward (*J. Amer. Chem. Soc.*, 1942, **64**, 2464—2468).—Aq. solubilities in the temp. range 23—50° have been measured and yield heats of dissolution: o -7820, m -9570, p - $\text{NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{SO}_2\cdot\text{NH}_2$ (I) at <37° 10,860 and at >37° 9050 g.-cal. per mol. The solubility curve of (I) shows a discontinuity at 37°, confirmed dilatometrically, and represents a transition involving a monohydrate. In buffered solutions of pH 1.2—12.4 at 37° solubilities are min. at pH 4.5—5.0 and increase rapidly at pH >9 and <3.

W. R. A.

Absorption of hydrogen by monocrystalline and polycrystalline iron. L. Moreau, G. Chaudron, and A. Portevin (*Compt. rend.*, 1942, **214**, 554—555).—A comparison and discussion of the changes in surface properties due to H_2 penetration of specimens of Fe heated at $\sim 800^\circ$ for 0—100 hr. in H_2 .

N. M. B.

Adsorption of gases at low temperature and pressure on smooth silver. M. H. Armbruster (*J. Amer. Chem. Soc.*, 1942, **64**, 2545—2553).—Adsorption of H_2 , N_2 , A, CO, CO_2 , and O_2 at pressures up to 0.1 cm. on a substantially plane reduced surface of Ag has been

measured from -195° to 20° . H_2 is not measurably sorbed at any temp. A, N_2 , and CO are sorbed at -195° and -183° but not at -78° or 20° . CO_2 is sorbed at -78° to a slight extent at 0.02 cm., but not at 20° . The adsorption is always instantaneous and reversible. O_2 is sorbed at -195° and -183° and, although most of the gas appears to be held by van der Waals forces, some cannot be removed by pumping at higher temp. At -78° and 20° there is activated adsorption of O_2 . All the isotherms are satisfactorily represented by the Langmuir equation and are of the type observed with a plane surface of other metals. The vals. of the limiting vol., V_∞ , derived from the slope of the p/v - p isotherm, correspond with a surface only partly covered, to an extent varying from ~ 20 to 90% of a close-packed unilayer. Results of force-area curves, derived by two different methods, differ considerably. The adsorption of O_2 on smooth Ag and the adsorption of O_2 on finely-divided Ag as reported by Benton *et al.* (A., 1927, 118; 1934, 370) are compared.

W. R. A.

Sorption of carbon monoxide by metals. Temperature variation experiments. C. W. Griffin (*J. Amer. Chem. Soc.*, 1942, **64**, 2610—2613).—Sorption of CO on supported Cu and on massive and supported Pb has been measured with temp. variation. Results are similar to those for H_2 on massive and supported metals and indicate that dissolution occurs as well as adsorption.

W. R. A.

Adsorption and energy changes at crystalline solid surfaces. G. E. Boyd and H. K. Livingston (*J. Amer. Chem. Soc.*, 1942, **64**, 2383—2388).—The change in free energy on immersion in a saturated vapour has been determined for non-porous cryst. TiO_2 , SiO_2 , BaSO_4 , SnO_2 , and graphite by graphical integration of vapour adsorption data utilising the Gibbs adsorption relation. The free energy change on immersion in a liquid and the work of adhesion of a liquid to a solid surface have also been derived. If the equilibrium contact angle is $>0^\circ$ a duplex angle cannot exist, but a unilayer may cover the surface of the solid.

W. R. A.

Fibrous aluminium oxide and its use as an adsorbent in adsorption-metry and chromatography. H. Wislicenus (*Kolloid-Z.*, 1942, **100**, 66—82).—A summary of the properties, evaluation, prep. (given in detail), and applications of activated Al_2O_3 .

F. L. U.

Relative surface tension of potassium chloride solutions by a differential bubble pressure method. F. A. Long and G. C. Nutting (*J. Amer. Chem. Soc.*, 1942, **64**, 2476—2482).—Vals. of relative γ of KCl solutions, measured by a differential max. bubble pressure apparatus (described), differ from recorded data. The γ -concn. curve has no min. and the results are in accord with the Onsager-Samaras predictions.

W. R. A.

Attachment and detachment of dropping mercury under various conditions. I. M. Koithoff and G. J. Kahan (*J. Amer. Chem. Soc.*, 1942, **64**, 2553—2557).—An abnormally large drop time was found when electrically disconnected Hg drops into air-saturated H_2O or when Hg connected with a pool of Hg drops into air-free H_2O . The drop of Hg remains attached to the glass. The smaller is the bore of the capillary the more pronounced this abnormal behaviour becomes. The results obtained with an abnormally dropping capillary are badly reproducible and depend greatly on the degree of inclination of the capillary. The abnormal behaviour has been interpreted on the basis of interaction between the electrical double layers at the glass- and at the Hg-aq. phase interfaces.

W. R. A.

Spontaneously forming emulsions. Mechanism of formation of soluble oils. Adsorption layers in disperse systems. K. Pospelova and P. Reh binder (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 71—87).—Systems consisting of Na oleate or a naphthenic soap, a mineral oil, and a soap of a sulphonated castor oil are studied, and regions of stability for emulsols and sol. oils are plotted. Dispersivity data are also recorded and discussed. Sol. oils are systems containing hydrocarbon sufficient only to build up a firmly-bound "superstructure" of mols. on the soap micelles; emulsols contain a larger quantity of hydrocarbon, the excess being held to the micelles by weak wetting forces. Transformation of a mineral oil-soap mixture into an emulsol occurs by a phase inversion process at a crit. $[\text{H}_2\text{O}]$. When an emulsol is diluted with H_2O the excess oil mols. become detached from the micelles and coalesce to droplets, the sol. oil formed simultaneously acting as an emulsifier.

A. J. E. W.

Calculation of dimensions of colloidal particles from the scattering of X-rays at small angles. O. Kratky (*Naturwiss.*, 1942, **30**, 542—543).—The investigation is carried out for a close-packed system in which the space between the colloidal particles is small compared with the vol. of the particles. An expression is obtained by which it is possible to calculate the size of colloidal particles from the small-angle diffraction diagram.

A. J. M.

Solubility of substances of high mol. wt. VIII. Dependence of solubility on mol. wt. G. V. Schulz and B. Jirgensons (*Z. physikal. Chem.*, 1940, **B**, 46, 105—136; cf. A., 1940, I, 24).—The variation of the solubility of high-mol. wt. substances with mol. wt. and with the concn. of the pptg. liquid has been studied for the systems cellulose nitrate- CO_2 - H_2O , starch triacetate- CHCl_3 - Et_2O , polystyrene- C_6H_6 - MeOH , and polymerised $\text{CH}_2\text{CMe}\cdot\text{CO}_2\text{Me}$ - C_6H_6 —

cyclohexane. The results are in accord with the relationship derived previously, and the mol. wt. of such substances can be determined by pptn. measurements. The equilibrium between the two phases produced on adding the precipitant is discussed with reference to the energy of transfer of the macromols., their association in the solutions, and the effect of temp. on the compositions of the phases. J. W. S.

Sedimentation and diffusion measurements with the water-soluble polysaccharide from larch wood. H. Mosimann and T. Svedberg (*Kolloid-Z.*, 1942, 100, 99—105).—The polysaccharide consists of two components, of which one (α) was obtained in a pure state by centrifuging in a cell of special design as well as by fractional pptn. with EtOH. Determinations of the mol. wt. of α by Lamm's diffusion method and by sedimenting in the ultracentrifuge gave the same val., 16,000. The mol. wt. of the second component (β), which could not be obtained free from (α), is 100,000. The α component (an araban) is certainly, and the β (galactan) probably, homodisperse. F. L. U.

Colloid chemistry of the amyloses. M. Samec (*Kolloid-Z.*, 1942, 100, 106—110).—A summary. Further fields for investigation are indicated. F. L. U.

Deformation and orientation of isotropic cellulose nitrate fibres. H. R. Kruyt, D. Vermaas, and P. H. Hermans (*Kolloid-Z.*, 1942, 100, 111—121; cf. A., 1942, I, 397).—Measurements of the double refraction (δ) of cellulose nitrate fibres stretched to varying extents after immersion in EtOH, EtOH-COMe₂ mixtures, and other org. liquids are recorded. Relations between the rod- δ and adsorption- δ and extension are discussed. The observations lead to the conclusion that during extension of the swollen fibre breaking down of cryst. material, recrystallisation of amorphous material, and orientation of micelles occur. In EtOH-COMe₂ mixtures these processes occur simultaneously, in 100% EtOH consecutively. F. L. U.

Syneresis of silica gels containing addition agents. L. A. Munro and G. E. Monteith (*Canad. J. Res.*, 1942, 20, B, 212—220).—A standardised method of measuring syneresis is described. Investigations on SiO₂ gels containing MeOH, EtOH, (CH₃OH)₂, or glycerol show that the total vol. of syneretic liquid at equilibrium is the same as for the gel without addition, and that the concn. of the alcohol in the liquid is the same as in the initial gel, indicating that no adsorption of the alcohol occurs in the gel itself. J. W. S.

New type of double refraction in oriented gels. D. Vermaas (*Z. physikal. Chem.*, 1942, B, 52, 131—141).—Analysis of the double refraction exhibited by oriented cellulose nitrate swollen in various solvents indicates the presence of a fourth component arising from the mols. of the imbibed liquid oriented under the influence of the colloidal material. The variation of this "adsorption double refraction" with the degree of swelling of the gel has been investigated. J. W. S.

Physicochemical and electrokinetic properties of gels of silicic acid and aluminium hydroxide and some synthetic and natural aluminosilicates, especially in relation to ion exchange phenomena. S. P. Raychaudhuri and A. K. M. Qudrat Ghani (*J. Indian Chem. Soc.*, 1942, 19, 311—330).—Data are recorded for the electro-osmotic behaviour, base exchange capacities, and buffer curves of dialysed gels of SiO₂ and Al₂O₃ and of dialysed gels obtained by mixing sols of SiO₂ and Al₂O₃ in varying proportions. These properties are compared with corresponding properties of natural aluminosilicates. F. L. U.

VI.—KINETIC THEORY. THERMODYNAMICS.

Third dissociation constant of phosphoric acid and its variation with salt content. R. C. Wells (*J. Washington Acad. Sci.*, 1942, 32, 321—326).—H electrode measurements of solutions of phosphate mixtures have been made and the effect of added chlorides investigated. The effect of temp. on pH is small. For Na₂HPO₄ + Na₃PO₄ $pK_3 = 11.57 - 0.50\sqrt{M_P}$ at 27°, where M_P = combined molality of HPO₄²⁻ + PO₄³⁻. In presence of NaCl $pK_3 = 11.57 - 0.50\sqrt{M_P} - 0.98\sqrt{M_{NaCl}}$. The effect of sea salts (s) is very similar to that of NaCl and M_s can replace M_{NaCl} in the second equation. Since M_P is negligible in sea-H₂O, the equation for sea-H₂O at 27° becomes $pK_3 = 11.57 - 0.98\sqrt{M_s}$. C. R. H.

Spectrophotometric determination of dissociation constants of diphenylselenium dibromide and di-iodide. J. D. McCullough (*J. Amer. Chem. Soc.*, 1942, 64, 2672—2676).—Spectrophotometric studies of SePh₂Br₂ and SePh₂I₂ show that in CCl₄ they dissociate into SePh₂ and free halogen. Vals. of dissociation consts. at 26° ± 1° are 5.02×10^{-4} and 3.60×10^{-2} . Molar extinction coeffs. for SePh₂, SePh₂Br₂ and SePh₂I₂ are given. An accurate volumetric procedure for the determination of Se diaryl dihalide is described. W. R. A.

Revised constants for the Debye-Hückel theory. H. I. Stonehill and M. A. Berry (*J. Amer. Chem. Soc.*, 1942, 64, 2724—2725).—Revised vals. for h and g in the Debye-Hückel equation are $h\ 0.5103$, $g\ 0.3290 \times 10^8$. W. R. A.

Individual activities of thallium and nitrogen ions in solutions of thallium nitride [azide]. (Mme.) M. L. Brouty (*Compt. rend.*, 1942, 214, 480—483).—E.m.f. data lead to the vals. $E_0 = 0.3339$ and -0.2950 v. for Tl⁺ and N³⁻ respectively, the ionic radii being 0.6 and 8.5 Å., respectively. C. R. H.

System ethanol-methanol at 40°. A. C. Morris, L. T. Munn, and G. Anderson (*Canad. J. Res.*, 1942, 20, B, 207—211).—The total and partial v.p. of the system EtOH-MeOH have been measured at 40° over the entire concn. range. Within experimental error the partial pressure curves accord with Raoult's law and the total pressure-mol. composition curve is linear. J. W. S.

Equilibrium pressure of certain univariant systems. M. Dodé (*Compt. rend.*, 1942, 214, 549—551).—Mathematical. An examination of the passage of the univariant dissociation of a solid A into a solid A' not forming solid solutions with A , into the bivariant dissociation of liquid A when it forms a homogeneous solution with A' . Equations for the equilibrium pressure are derived, which account for the max. in the pressure-temp. relation and are in accord with experimental data for the dissociation of oxides of Cu. N. M. B.

Phase equilibria at high temperatures. R. R. White and G. G. Brown (*Ind. Eng. Chem.*, 1942, 34, 1162—1174).—Experimental liquid-vapour phase equilibrium data are given for petroleum fractions of b.p. 95—750° F. at temp. from 300° to 820° F. and at pressures from 50 to 700 lb. per sq. in. The results are used to extend the estimated ideal equilibrium vaporisation consts. to hydrocarbons of b.p. up to 925° F. at temp. from 0° to 1000° F. and at pressures from 15 to 1000 lb. per sq. in., and to develop a relation for estimating the vals. of the vaporisation consts. in the crit. and retrograde regions of complex hydrocarbon mixtures. D. F. R.

Equilibrium of carbon dioxide and carbon monoxide in contact with nickel and nickel oxide or with nickel, γ -alumina, and nickel aluminate, and its modification by the physical state of the solid reactants. R. Fricke and W. Weitbrecht (*Z. Elektrochem.*, 1942, 48, 389).—A correction (cf. A., 1942, I, 241). J. W. S.

Kinetics of formation of two-phase systems near the critical point. O. Todes and J. Zeldovitch (*Acta Physicochim. U.R.S.S.*, 1942, 16, 26—33).—Possible states of a system near the crit. point are (a) states such that small arbitrary changes lead eventually to phase separation, and (b) states which are stable with respect to small changes, but unstable with respect to a new phase. The characteristics of states of type (a) are considered. The rate of phase separation depends on the rate of heat exchange between the phases, the theory showing that c_p is negative for certain systems. Expressions are derived for the time of separation into phases. The existence of certain theoretically unattainable states is briefly considered. A. J. E. W.

Homeomorphous transformations of potassium chloride, bromide, and iodide in a homogeneous crystalline medium. A. G. Bergman (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 274—277).—Examination of available data together with data obtained by the author confirms the existence of polymorphous transformations for KCl at 27° and for KBr at 22°, accompanied by no pronounced reconstruction of the cryst. lattice. Breaks in the solubility curves of KCl, KBr, and KI occur at 27°, 20°, and 11°, respectively. C. R. H.

Iodine monochloride. IV. System potassium chloride-iodine monochloride. J. Cornog and E. E. Bauer (*J. Amer. Chem. Soc.*, 1942, 64, 2620—2624).—The v.p. of ICl between -15° and 50° has been measured by a dynamic method; the derived vals. of heats of fusion, vaporisation, and sublimation are: 1850, 9950, and 11,800 g.-cal. per mol. The v.p.-composition relations of the system KCl-ICl have been formulated. KCl_2ICl or KCl_3I_2 has been prepared by direct union of KCl and ICl at $<45^\circ$. The dissociation pressures of KCl, ICl and its monohydrate and of KCl_2ICl have been determined. Solubility curves for KCl, ICl and KCl_2ICl in ICl indicate a transition point at 45° . W. R. A.

Binary system CaSiO₃-diopside and the relations between CaSiO₃ and akermanite.—See A., 1943, I, 74.

System CaSiO₃-diopside-anorthite.—See A., 1943, I, 74.

The systems LiNO₃-NH₄NO₃ and LiNO₃-NH₄NO₃-H₂O. A. N. Campbell (*J. Amer. Chem. Soc.*, 1942, 64, 2680—2684).—Thermal analysis of the system LiNO₃-NH₄NO₃ has confirmed and extended the results of Perman and Harrison (A., 1924, ii, 756). The system LiNO₃-NH₄NO₃-H₂O has been investigated at 25°, 31°, 60°, and 90° by solubility technique. No compound is formed; solid NH₄NO₃ and LiNO₃ are mutually insol. LiNO₃ exists in only one cryst. form; the existence of LiNO₃·0.5H₂O is doubted. W. R. A.

System sodium nitrate-dioxan-water at 25°. B. Selikson and J. E. Ricci (*J. Amer. Chem. Soc.*, 1942, 64, 2474—2476).—Using the Karl Fischer reagent to determine the H₂O in equilibrium liquids, the solubility relationships in the system NaNO₃-dioxan-H₂O have been investigated at 25°. Exact vals. are given for the solubility of NaNO₃ at 25° in dioxan containing very small % of H₂O. W. R. A.

Heats of organic reactions. XIV. Digestion of β -lactoglobulin by pepsin. R. Haugaard and R. M. Roberts (*J. Amer. Chem. Soc.*, 1942, **64**, 2664—2671).—Native β -lactoglobulin (I) and (I) denatured by alkali were digested by pepsin at pH 1.5 and heat evolved, N precipitable by $\text{CCl}_3\cdot\text{CO}_2\text{H}$, increase in $\text{NH}_2\text{-N}$, and dialysable N have been measured in the same digest as a function of the time of digestion. The apparently simultaneous scission of a no. of peptide linkings whenever a mol. of (I) is attacked suggests that the elimination of one such linking greatly decreases the stability of the others. Since the thermal effect is not \propto the hydrolysis the digestion is probably accompanied by an exothermic non-hydrolytic process.

W. R. A.

Apparent energy of the N-N linking as calculated from heats of combustion. C. M. Anderson and E. C. Gilbert (*J. Amer. Chem. Soc.*, 1942, **64**, 2369—2372).—Isothermal heats of combustion have been determined for NH_2Ph , NH_2Bz , $(\text{NHBz})_2$ (I), NHPh_2 , $\text{NHPh}\cdot\text{NH}_2$ (II), and N_2Ph_4 (III). Vals. for the energy of the N-N linking in (I), (II), (III), and $(\text{NHPh})_2$ have been calc.; they depend on the nature of the substituent groups attached to N.

W. R. A.

Thermochemistry of acid dissociation. Proton affinities of acid anions. G. Briegleb (*Naturwiss.*, 1942, **30**, 436—439).—The proton affinities (P) of the anions of H_2O , PhOH , AcOH , HCO_2H , $\text{CH}_2\text{Cl}\cdot\text{CO}_2\text{H}$, and the halogen acids have been evaluated. P for the halogen acids is 60—70 kg.-cal. < for the weak acids. For the latter P increases slightly with decreasing dissociation const., being 380 kg.-cal. for $\text{CH}_2\text{Cl}\cdot\text{CO}_2\text{H}$ and rising to 386 kg.-cal. for PhOH . For H_2O $P = 392$ kg.-cal. The data are discussed with reference to the thermochemistry of dissociation and hydration.

C. R. H.

Calculation of free energies of formation from ternary phase diagrams. F. Halla (*Z. physikal. Chem.*, 1940, **A**, 185, 426—434).—Theoretical. The author's method of calculating free energies of formation of the binary phase of two-component systems (cf. A., 1936, 290) has been extended to three-component systems and illustrated with data for eight metallic systems.

C. R. H.

VII.—ELECTROCHEMISTRY.

Temperature coefficient of the conductance of potassium chloride solutions. A. R. Gordon (*J. Amer. Chem. Soc.*, 1942, **64**, 2517).—Li and Fang's data (A., 1942, I, 399) for 30° and 40° should for the present be treated with reserve.

W. R. A.

Effect of centrifugal fields on the electromotive force of galvanic cells. D. A. MacInnes (*Ann. New York Acad. Sci.*, 1942, **43**, 243—251).—A mathematical treatment and a discussion of some experimental methods and results.

N. M. B.

Oxidation-reduction potentials of the platinum compounds including organic amines and glycine. A. A. Grünberg and V. N. Lavrentiev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 203—205).—Oxidation-reduction potentials (E) at 25° of (a) $[\text{Pt}(\text{NH}_2\text{R})_2\text{Cl}_2] + 2\text{Cl}' \rightleftharpoons [\text{Pt}(\text{NH}_2\text{R})_2\text{Cl}_4] + 2e$ (*cis* and *trans*) ($\text{R} = \text{H}$, Et), (b) $[\text{Pt}(\text{NH}_2\cdot\text{CH}_2)_2\text{Cl}_2] + 2\text{Cl}' \rightleftharpoons [\text{Pt}(\text{NH}_2\cdot\text{CH}_2)_2\text{Cl}_4] + 2e$, and (c) $[\text{Pt}(\text{NH}_2\cdot\text{CH}_2\cdot\text{CO}_2\text{H})_2] + 2\text{Cl}' \rightleftharpoons [\text{Pt}(\text{NH}_2\cdot\text{CH}_2\cdot\text{CO}_2\text{H})_2\text{Cl}_2] + 2e$ (*cis* and *trans*) in N-NaCl are > in N-HCl (cf. A., 1940, I, 295), by 26 and 29 mv. for the *cis* and *trans* systems respectively, which is about the same as for $[\text{PtCl}_4]'' + 2\text{Cl}' \rightleftharpoons [\text{PtCl}_6] + 2e$. The vals. of E for (a) $\text{R} = \text{Et}$ > for (a) $\text{R} = \text{H}$ > for (b). Exceptionally (c) has lower vals. of E which for the *cis* is greater by 13 mv. than for the *trans* system.

F. R. G.

Iron electrode potential in a magnetic field. A. L. Parson (*Nature*, 1942, **150**, 605—606).—A brief account of an experimental test of reported observations of p.d. between two Fe electrodes one of which is in a magnetic field and the other is not, e.g., p.d. of 0.05 v. for 30,000 gauss, by Paillot and others. In the tests described p.d. of this order are observable but are built up so slowly and irregularly as to suggest that they have no significance in magnetic theory and are attributable to subsidiary causes, such as reaction between the Fe^{II} salt used and O_2 .

W. J.

Cathodic polarisation of zinc. O. Essin (*Acta Physicochim.*, U.R.S.S., 1942, **16**, 102—119).—Polarisation curves are given for discharge of Zn from 0.05—0.5M- ZnSO_4 in $\text{N-H}_2\text{SO}_4$, 0.04—0.08M- ZnO in 4N-KOH, and 0.66M- $\text{Na}_2\text{Zn}(\text{CN})_4$ alone and with added NaCN or KOH, with a Hg jet cathode. Discharge is slow in all cases, and (except with ZnSO_4) is accompanied by polarisation due to slow dissociation of complex ions. This dissociation proceeds much more rapidly on a Zn cathode than on Hg.

A. J. E. W.

Temperature correction equations for ionic concentration determinations. F. Lieneweg (*Z. tech. Physik*, 1942, **23**, 145—148).—The variation of the e.m.f. of cells when the electrodes are at different temp. is investigated, and expressions are obtained for the curves of e.m.f. against pH at different temp., and of e.m.f. against temp. for different pH vals.

A. J. M.

Overvoltage. XIV. Hydrogen decomposition potentials under various conditions in acid solutions at platinised platinum electrodes. A. L. Ferguson and M. B. Towns (*Trans. Electrochem. Soc.*, 1942, **82**, Preprint 26, 301—317; cf. A., 1943, I, 18).—Using platinised Pt cathodes in 2N- H_2SO_4 , a study has been made of the influence on

cathode change curves of conditions which alter the H_2 concn. on the solution side of the electrode-electrolyte interface. The cathode potential, both above and below the so-called reversible val., can be appreciably altered for a given c.d. by conditions on the solution side of the interface which influence the rate of diffusion of H_2 towards or away from the interface. The changes produced support the theory of polarisation potential proposed previously (A., 1942, I, 241).

C. E. H.

Reduction of unsaturated hydrocarbons at the dropping mercury electrode. II. Aromatic polynuclear hydrocarbons. S. Wawzonek and H. Laitinen (*J. Amer. Chem. Soc.*, 1942, **64**, 2365—2368; cf. A., 1942, I, 400).—Half-wave potentials (P) and diffusion current consts. (c) for 17 aromatic polynuclear hydrocarbons have been determined. P is independent of concn. but is characteristic of certain structures, whereas $c \propto$ concn. The polarographic method is useful in determining hydrocarbons and the arrangements of double bonds in their various rings.

W. R. A.

Influence of colloids on electrode processes.—See B., 1943, I, 73.

VIII.—REACTIONS.

New kinetic effect. N. M. Emanuel (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 250—254).—The effect of pretreatment of $\text{H}_2\text{S-O}_2$ mixtures on the flash within the region of ignition and on the kinetics near the region has been investigated. The flash operation replaces the indicator bulb as a means of investigating the kinetics of a slow reaction and is extended to the study of the kinetics of the intermediate products. It is shown that max. [SO] is attained at 260—280° and that [SO] is independent of initial pressure but \propto pressure displacement as a result of pretreatment.

C. R. H.

Exchange of the Cl of H^{35}Cl with AsCl_3 , PCl_3 , POCl_3 , CCl_4 , SiCl_4 , S_2Cl_2 , and KCl . K. Clusius and H. Haimert (*Z. physikal. Chem.*, 1942, **B**, 51, 347—351).—The homogeneous gas exchange of the Cl of H^{35}Cl (3% H^{37}Cl : 97% H^{35}Cl) is rapid for PCl_3 and AsCl_3 , slower for POCl_3 , very slow for SiCl_4 and S_2Cl_2 , and negligible for CCl_4 . By using fine and coarse powders of KCl, the exchange is shown to be limited to the surface layers. A mechanism involving additive compounds, e.g., HPCl_4 and H_2SiCl_6 , is postulated.

W. R. A.

Reactions in solutions containing O_3 , H_2O_2 , H^+ , and Br^- . Specific rate of the reaction between O_3 and Br^- . H. Taube (*J. Amer. Chem. Soc.*, 1942, **64**, 2468—2474).—Variation of the rate of the reaction $\text{H}_2\text{O}_2 + \text{O}_3 = 2\text{O}_2 + \text{H}_2\text{O}$ (A) with $[\text{O}_3]$, $[\text{H}_2\text{O}_2]$, $[\text{H}^+]$, and $[\text{Br}^-]$ has been investigated. (A) proceeds by three paths: (i) a non-chain path, involving oxidation of Br^- by O_3 to OBr^- (sp. rate 1600 ± 100) and reduction of OBr^- by H_2O_2 (sp. rate 9×10^5); (ii) a chain reaction, initiated by $\text{H}_2\text{O}_2 + \text{O}_3 \rightarrow \text{HO} + \text{HO}_2 + \text{O}_2$, continued by $\text{HO}_2 + \text{O}_3 \rightarrow \text{HO} + 2\text{O}_2$, $\text{HO} + \text{H}^+ + \text{Br}^- = \text{H}_2\text{O} + \text{Br}$, $\text{Br} + \text{H}_2\text{O}_2 \rightarrow \text{H}^+ + \text{Br}^- + \text{HO}_2$, and broken by $\text{HO}_2 + \text{Br} \rightarrow \text{H}^+ + \text{Br}^- + \text{O}_2$; (iii) a chain reaction, initiated by $\text{Br}_2 + \text{O}_3 + \text{H}_2\text{O} \rightarrow \text{HO} + \text{Br} + \text{BrOH} + \text{O}_2$ or $\text{HO}_2 + \text{Br} + \text{Br}^- + \text{H}^+ + \text{O}_2$, and broken by $\text{Br} + \text{Br} \rightarrow \text{Br}_2$. The nature of the chain-breaking step depends on the ratio $[\text{O}_3] : [\text{H}_2\text{O}_2]$. No evidence for the oxidation of Br^- by O_3 by a free radical process was found.

W. R. A.

Study of mechanism of chemical reactions with oxygen isotopes. II. Mechanism of the Beckmann rearrangement. G. Mikluchin and A. Brodski (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 63—70).—Experiments with H_2O enriched in ^{18}O show that no exchange occurs between H_2O and NHPhBz in an acid or neutral medium; no exchange occurs between H_2O and NHPhAc in a neutral medium, but in acid slow exchange is detected. Reaction of $\text{CPh}_2\cdot\text{N}\cdot\text{OH}$ with H_2O and PCl_5 in the cold is accompanied by O exchange, showing that the Beckmann rearrangement occurs by an intermediate elimination of O as H_2O , and not by direct intramol. rearrangement.

A. J. E. W.

Hydrolysis of aliphatic nitriles in concentrated hydrochloric acid solutions. B. S. Rabinovitch and C. A. Winkler (*Canad. J. Res.*, 1942, **20**, B, 221—230).—The rates of hydrolysis of HCN , MeCN , and $\text{CN}\cdot\text{CH}_2\cdot\text{CO}_2\text{H}$ in 1—8.5N-HCl have been studied over various temp. ranges. The results indicate that the consecutive hydrolyses of the nitrile and of the amide are each unimol. reactions, the ratio of the velocity coeffs. of these reactions being the greater the greater is the [HCl]. In each case the energy of activation of the reaction decreases rapidly with increasing [HCl].

J. W. S.

Kinetics of the alkaline hydrolysis of propionitrile. B. S. Rabinovitch and C. A. Winkler (*Canad. J. Res.*, 1942, **20**, B, 185—188).—The hydrolysis of EtCN in 0.3—4N-NaOH has been studied at 39.5° and 59.6°. Determinations of the $[\text{EtCO}\cdot\text{NH}_2]$ and $[\text{NH}_3]$ indicate that the initial reaction is bimol. and that the relative rates of hydrolysis of EtCN and $\text{EtCO}\cdot\text{NH}_2$ are $\sim 1 : 10$. The bimol. velocity coeff. is almost independent of the [NaOH]. In 0.65N-NaOH the energy of activation is $\sim 20,300$ g.-cal. per g.-mol.

J. W. S.

Mechanism of chemiluminescent reactions of oxidation with hydrogen peroxide. B. J. Sveschnikov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 278—283).—The kinetics of chemiluminescence of 3-amino-, 3-acetamido-, and 3-hydroxy-phthalhydrazide, luci-

genin, and pyrogallol when oxidised with H_2O_2 in an alkaline medium have been studied. The data support the view that the excited mol. is due to a series of subsequent transformations of a single mol. of the primary substance, and that the splitting of H_2O_2 by alkali proceeds via a chain reaction involving intermediate products. Lack of knowledge of the kinetics of splitting of H_2O_2 both in absence and in presence of luminescent substances hinders further elucidation of the kinetics of chemiluminescence. C. R. H.

Reactions of alkyl halides with hydrogen halides. H. P. Meissner and H. J. Schumacher (*Z. physikal. Chem.*, 1940, **A**, 185, 435—446).— MeBr and MeCl react with HI above 350° and 325° , respectively, the reaction products being CH_4 , I_2 , HBr (HCl), and, additionally for MeBr , C and a residual gas. The reaction is heterogeneous. The halides do not react with HBr at temp. $<$ their respective decomp. temp. The thermal decomp. of MeBr has also been investigated. The decomp. products are HBr , CH_4 , H_2 , C , and a liquid Br compound. This reaction, which is homogeneous, is slightly inhibited by HBr and CH_4 but unaffected by N_2 . C. R. H.

Catalysts for peroxide decomposition. M. Bobtelsky and A. E. Simchen (*J. Amer. Chem. Soc.*, 1942, **64**, 2492—2498; cf. A., 1937, **I**, 523).—A mixture of Co^{++} , citrate ions, and H_2O_2 (1 : 1 : 1) yields a pink peroxidised compound (I) which decomposes with liberation of all the disposable O into a green Co^{II} citrate complex (II). (II) can be obtained by peroxidising (I) with PbO_2 or MnO_2 . (II) is an extremely active catalyst for the decomp. of H_2O_2 but does not decompose PbO_2 or MnO_2 . The citrates are not attacked but when the corresponding tartrates are used, the tartrate ion is attacked. The properties of the complexes have been examined by gasometric, photometric, and conductometric methods. W. R. A.

Kinetics of amination of organic halides in liquid ammonia. G. S. Markova and A. I. Schatenstein (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 68—70).—Unimol. velocity coeffs. (k) are recorded for reaction of liquid NH_3 at 25° with a no. of RCl , RBr , and RI at concn. 0.33 mol.-% RX , where R is an alkyl radical up to C_{12} . k is increased by the presence of salts in the order $\text{Li}^+ > \text{Na}^+, \text{Ca}^{++} > \text{Sr}^{++} > \text{Ba}^{++}$, $\text{Br}^- > \text{NO}_3^- > \text{ClO}_4^-$. L. J. J.

Polyacrylic acid glasses. E. Jenckel and E. Bräucker (*Z. physikal. Chem.*, 1940, **A**, 185, 465—468).—The polymerisation of xylene solutions of $\text{CH}_2=\text{CH}\cdot\text{CO}_2\text{H}$ has been investigated over the range 80 — 250° . The increase in rate of polymerisation with temp. is rapid and above 130° the reaction is explosive. The mol. wts. of the polymerides are $\sim 17,000$ — $21,000$ for polymerisation temp. 90 — 130° . The temp.-vol. curves show that the sol. and insol. forms are typical glasses. C. R. H.

Absolute rate of heterogeneous reactions. C. S. Bagdasarian (*J. Phys. Chem. Russ.*, 1941, **15**, 40—49).—Temkin's theory (cf. A., 1938, **I**, 396) is developed for reactions of the zero, the first, and the second order, and the final expressions are compared with experimental data. J. J. B.

Action of chlorine on anhydrous metallic oxides at room temperature. P. Pierron (*Compt. rend.*, 1941, **213**, 840—841).—The action of Cl_2 on Ag_2O and HgO is rapid. Na_2O , Li_2O , and CdO react slowly. The oxidising action of the products is $<$ that of the O_2 absorbed. With Na_2O it is due to Na_2O_2 , NaClO_3 , and some NaOCl . With BaO it is due to BaO_2 . Other oxides give no oxidising products. Cl_2O is observed in gaseous products from Cl_2 and HgO or CdO . O. D. S.

Heterogeneous process in the layer of solid particles used as a chemical reagent. B. V. Kantorovitch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 167—171).—Formulae relating the apparent velocity coeff. of a heterogeneous reaction, assuming infinite true velocity coeff., with hydrodynamic boundary-layer factors are developed. L. J. J.

Decomposition of diethyl ether induced by chlorine. H. P. Meissner and H. J. Schumacher (*Z. physikal. Chem.*, 1940, **A**, 185, 447—464).— Cl_2 reacts with Et_2O at temp. $> 350^\circ$ with the momentary formation of MeCHO , EtCl , and HCl . This reaction is followed by a more complicated catalytic reaction in which, in addition to the excess of Et_2O , MeCHO and EtCl decompose. The catalyst is not Cl_2 but is probably a substance, gaseous at -110° , which is formed by the interaction of Cl_2 and MeCHO . C. R. H.

Influence of temperature on the slow and induced oxidation of glucose in the dark. N. R. Dhar (*J. Indian Chem. Soc.*, 1942, **19**, 331—332).—The rate of oxidation of glucose solution by air in the dark increases with rise of temp. to a max. between 30° and 40° and then decreases, both in the absence of an inductor and in presence of $\text{Fe}(\text{OH})_2$. With $\text{Ce}(\text{OH})_3$ as inductor the rate is much higher, and increases continuously with rise of temp. between 10° and 50° . F. L. U.

Active contact catalysts, their formation and nature. I. Nature of the active surface. S. Z. Roginski (*J. Phys. Chem. Russ.*, 1941, **15**, 1—30).—The activity of solid catalysts cannot be due to physical irregularities (lattice distortions etc.) as these rapidly disappear at temp. $<$ the working temp. of the catalyst. Chemical impurities including gases are not easily eliminated by heat and determine the

activity; all catalysts contain promoters. Degassing of metals (Pt , Pd , Ni , W) lowers their activity $>$ does heat. If to degassed metal a gas (H_2 , O_2 , N_2 , but not A) is added, the activity towards the hydrogenation of C_2H_2 shows a sharp max. when 1 atom of the gas is present for 100—1000 atoms of metal, O_2 being a better promoter than N_2 and H_2 . The thermionic work function of W shows a min. at nearly the same ratio $\text{O}_2 : \text{W} = 1 : 400$ as that at which the activity is a max. The sp. surface areas of inactive (without O_2) and active Ni (with O_2) are identical, as shown by adsorption of A ; the adsorption of H_2 and of C_2H_2 by active Ni is much larger. The activation consists in lowering the activation energy E of the reaction. Mechanisms to account for the min. of E at the best ratio $\text{O}_2 : \text{W}$ are discussed. Promoters and poisons are the same substances applied in different concns. J. J. B.

Combustion of carbon monoxide on Hopcalite and on its components. G. M. Schwab and G. Drikos (*Z. physikal. Chem.*, 1940, **A**, 185, 405—425).—The reduction of CuO , MnO_2 , and Hopcalite (I) begins at 140° , 30° , and 70° , respectively; reoxidation by O_2 begins at room temp., 100° , and room temp. respectively. For $\text{CO}-\text{O}_2$ mixtures the reaction velocity (k) $\propto [\text{CO}]$. In reducing mixtures the initial high k decreases with increasing reduction attaining a const. val. $\propto [\text{O}_2]$ for MnO_2 and (I), but decreasing continuously for CuO . $k \propto$ gas stream velocity. The abs. k at a given temp. is approx. equal for MnO_2 and (I), but in the case of CuO this val. of abs. k is attained only at a temp. 100° higher. For CuO and (I) catalytic reduction is the step which determines the val. of k . C. R. H.

Kinetics of catalytic combustion of carbon monoxide on copper oxide. Absolute calculation of catalytic reaction velocity. G. M. Schwab and G. Drikos (*Z. physikal. Chem.*, 1942, **B**, 52, 234—252).—The rate of the catalytic combustion of CO on CuO at pressures between 0.3 and 150 mm. and between 300° and $430^\circ \propto [\text{CO}]$, but is independent of $[\text{CO}_2]$ and $[\text{O}_2]$. The heat of activation is 18 kcal. per mol. The calculation of adsorption coeffs. and of velocity coeffs. is discussed. W. R. A.

Carbon deposition in the decomposition of ethylbenzene on metal surfaces and the study of this process by means of a photoelement. A. A. Balandin and V. V. Patrikeev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 88—92).— C deposition occurring in high-temp. catalytic processes is studied by following the decrease in the amount of light reflected on to a photo-electric cell from a highly polished metal surface held in the reaction chamber. The method has been applied to the study of the catalytic decomp. of PhEt in presence and in absence of unsaturated hydrocarbons. The reaction has an induction period which decreases with rise of temp. from 450° to 650° ; the rate of C formation also increases with temp. J. L. E.

Electrodeposition of iron-tungsten alloys from an acid plating bath.—See B., 1943, **I**, 72.

Diffusion theory of the co-deposition of gold and copper.—See B., 1943, **I**, 75.

Theory of the industrial electrolytic production of aluminium.—See B., 1943, **I**, 76.

Mercury-photosensitised reactions of ethylene at high temperatures. D. J. LeRoy and E. W. R. Steacie (*J. Chem. Physics*, 1942, **10**, 676—682).—Data for the $\text{Hg} (^3\text{P}_1)$ -photosensitised reactions of C_2H_4 , which have been obtained over the range 25 — 350° , show that in addition to the reactions $\text{Hg} (^3\text{P}_1) + \text{C}_2\text{H}_4 \rightarrow \text{C}_2\text{H}_4^*$; $\text{C}_2\text{H}_4^* + \text{C}_2\text{H}_4 \rightarrow 2\text{C}_2\text{H}_4$; and $\text{C}_2\text{H}_4 \rightarrow \text{C}_2\text{H}_2 + \text{H}_2$ there occurs $\text{Hg} (^3\text{P}_1) + \text{C}_2\text{H}_4 \rightarrow \text{C}_2\text{H}_3 + \text{H} + \text{Hg} (^1\text{S}_0)$, the fourth reaction occurring only to a small extent at 25° . The increased quantum yield at high temp. is due either to the using up of the increased no. of $\text{Hg} (^3\text{P}_1)$ atoms in the fourth reaction or, more probably, to higher quantum yield of the H atom- and vinyl radical-sensitised polymerisation of C_2H_4 . The data are compared with similar data for other sensitisers. C. R. H.

Cadmium ($^3\text{P}_1$)-photosensitised reactions of the lower olefines. D. J. LeRoy and E. W. R. Steacie (*J. Chem. Physics*, 1942, **10**, 683—685).—The $\text{Cd} (^3\text{P}_1)$ -sensitisation of C_2H_4 , C_3H_6 , Δ^a - and Δ^b - C_4H_8 has been investigated. The reaction rates for the last three olefines are \ll for C_2H_4 . The low rates are attributed to the influence of the $\text{C}\cdot\text{C}$ linking on the quenching process rather than to the strength of the $\text{C}\cdot\text{H}$ linking. C. R. H.

Photochemical studies. XXXV. Photochemical decomposition of methyl *n*-butyl ketone. W. Davis, jun., and W. A. Noyes, jun. (*J. Amer. Chem. Soc.*, 1942, **64**, 2676—2678).—For unfiltered Hg radiation and for 3130 Å. the chief decomp. products of COMeBu^a at room temp. and 5—13 mm. are compounds with empirical formulae C_3H_6 and $\text{C}_3\text{H}_8\text{O}$. Small amounts of CO are found but it is uncertain whether CO is a primary product of decomp. W. R. A.

Oxidation of ascorbic acid and ultra-violet irradiation of water. R. Guillemet (*Compt. rend.*, 1942, **214**, 540—542).—There is evidence that, in presence of O_2 which is readily activated by radiation, H_2O is oxidised to H_2O_2 and this in turn effects the oxidation of the ascorbic acid. In absence of free O_2 the H_2O is oxidised less readily, with elimination of H_2 to H_2O_2 which then effects oxidation. N. M. B.

Action of gases on the photogenic reaction accompanying the electrolysis of sodium azide and azoimide. E. T. Verdier (*Compt. rend.*, 1942, 214, 617—619).—The ultra-violet emission accompanying electrolysis of HN_3 and NaN_3 is increased 500—600 times in presence of N_2 or H_2 (bubbled through anodic electrolyte), whilst A and N_2O are without influence and O_2 inhibits the emission. A chain mechanism involving N_2^+ , N , NH , and H is suggested.

Intensity relationships with the ultramicroscope. I. Blackening of photographic plates by electron beams. B. von Borries (*Physikal. Z.*, 1942, 43, 190—204).—The relation between the photographic blackening effect and the density of impinging 12.8—220-kv. electrons has been studied with 16 commercial emulsions; the results are shown as blackening curves, which are compared with curves obtained with visible light. The "energy density" required to produce a given blackening varies with the electron energy (E), and has a min. val. (at $E = 30$ —80 kv.) characteristic of the emulsion; the optimum E val. is approx. that at which the range of the electrons in the emulsion equals the emulsion thickness. X-Rays excited in the emulsion do not contribute appreciably to the blackening. At high E the blackening can be increased by superposing an unsensitised film (Al or Cellophane) of suitable thickness on the emulsion.

A. J. E. W.

IX.—METHODS OF PREPARATION.

Chemical separation of isotopes of hydrogen by addition of metals and compounds of metals to water, acids, and bases. I. Relative efficiencies of specific reactions. Effects of factors other than temperature. H. L. Johnston and C. O. Davis (*J. Amer. Chem. Soc.*, 1942, 64, 2613—2620).—The extent of isotopic separation occurring in the following reactions which liberate H_2 or gaseous hydrides has been determined: Li , Na , K , Ca , CaC_2 , and Al_4C_3 with H_2O ; Mg , Zn , Fe , Mn , Al , and FeS with aq. H_2SO_4 ; and Al with aq. NaOH . Runs were usually made at or near room temp. H_2 and hydrides were burned in a flame, with a slight excess of tank O_2 , and H_2O of combustion was carefully purified and analysed by the free submerged float method for its H isotope proportions. Corrections were applied for the ^{18}O abnormality of the tank O_2 , which was determined separately. For a given set of reagents, data were reproducible and confirm the applicability of the quant. relationship $d \log_e [\text{H}] = \alpha d \log_e [\text{D}]$ in which $[\text{H}]$ and $[\text{D}]$ are instantaneous vals. of the amounts of H and D , in the liquid phase, and α is the "isotope separation factor," different for each reaction. The form of this relationship is identical with that which pertains to the isotopic separations by electrolysis. The regularities in the results and their bearing on some phases of the reaction mechanism are discussed.

W. R. A.

Products obtained by the reducing action of metals on salts in liquid ammonia solution. VIII. Reduction of complex cyanides. J. W. Eastes and W. M. Burgess (*J. Amer. Chem. Soc.*, 1942, 64, 2715—2716).—The complex cyanides of Cd , Cu , Ag , and Zn , unlike Ni , are reduced to the free metal by alkali metals in liquid NH_3 solutions. Under the experimental conditions all the pptd. metals were pyrophoric except Zn . Alkali nickelocyanides are reduced by Ca in liquid NH_3 solution, giving the same type of products as those obtained by reduction with alkali metals.

W. R. A.

Hydrolysis of cadmium acetate. (Mlle.) M. Quintin (*Compt. rend.*, 1942, 214, 538—540).—Measurements show that the salt undergoes a type of hydrolysis intermediate between that of CdCl_2 and CdSO_4 on the one hand, and $(\text{PhSO}_3)_2\text{Cd}$ on the other hand. This explains the anomalies shown at high dilution.

N. M. B.

Reduction by hydrogen of lead and silver oxides. J. M. Dunoyer (*Compt. rend.*, 1942, 214, 556—557).—The pressure-temp. curves of H_2 during the reduction of the heated oxides are given. The reduction PbO_2 (175—200°) \rightarrow PbO (~275°) \rightarrow Pb shows evidence of the intermediate formation of Pb_2O at ~340°; this is not shown in the direct reduction of litharge. The reduction of Ag_2O begins at 50°; the intermediate formation of Ag_4O , below 100°, converted at 125° into Ag , is clearly shown by the curve.

N. M. B.

Magnetic study of the reaction $\text{AsBr}_3 + \text{Br}_2 \rightleftharpoons \text{AsBr}_5$. (Miss) K. Savithri (*Proc. Indian Acad. Sci.*, 1942, 16, A, 196—206).—Determinations of χ by the Gouy method show that solutions of AsBr_3 in AcOH obey the additive law, but solutions of Br in AcOH exhibit small departures. Equal vols. of equimol. solutions of AsBr_3 in AcOH and Br in AcOH , on mixing, give vals. of ρ and χ < calc. vals., and this is attributed to formation of AsBr_5 . The magnetic evidence for the possible presence of a slightly partial double bond between As and attached Br atoms is discussed.

W. R. A.

Family of oxyhalides. L. G. Sillén (*Naturwiss.*, 1942, 30, 318—324).—Crystallisation of Bi_2O_3 from LiCl gives a compound $\text{LiBi}_3\text{O}_4\text{Cl}_2$. This is typical of a no. of similar substances, e.g., $\text{SrBi}_3\text{O}_8\text{Cl}_3$, $\text{CdBi}_3\text{O}_8\text{Br}$, $\text{Cd}_{11}\text{Bi}_{14}\text{O}_{24}\text{Cl}_3$, which possess similar X-ray structures, but different formulæ. The structures of a large no. of these compounds have been investigated. They are tetragonal with $a \sim 3.9$ Å., but c varying from 7 to 50 Å. The oxyhalides of the

type $\text{Cd}_{2-3x}\text{Bi}_{1+2x}\text{O}_2\text{Cl}_3$ are to be regarded as phases rather than compounds or solid solutions.

A. J. M.

Study of mechanism of alkali fusion reactions with the heavy oxygen isotope. I. Makolkin (*Acta Physicochim. U.R.S.S.*, 1942, 16, 88—96).—Alkali fusions of PhSO_3Na , $\text{C}_{10}\text{H}_7\text{SO}_3\text{Na}$, and Na alizarin-sulphonate (**I**) have been carried out with NaOH enriched in ^{18}O . The exchange phenomena accompanying the reactions show that NaOH mols. are first attached to the aromatic nucleus; NaHSO_3 mols. are then eliminated, and react with more NaOH to give Na_2SO_3 . With (**I**) oxidation of the second C atom occurs by attachment of ONa from the NaOH , and not by removal of O from the CO group or from the atm. Complete O exchange occurs between H_2O and Na_2SO_3 in 20 hr. at 170°; measurable exchange also occurs between NaOH and the Na phenoxides.

A. J. E. W.

Composition and structure of molybdenum-blue. F. B. Schirmer, jun., L. F. Audrieth, S. T. Gross, D. S. McClellan, and L. J. Seppi (*J. Amer. Chem. Soc.*, 1942, 64, 2543—2545).—Mo-blue has been prepared by a no. of new methods and all samples have the empirical formula $\text{Mo}_8\text{O}_{23} \cdot x\text{H}_2\text{O}$ and yield identical X-ray diffraction patterns. Electron photomicrographs confirm the colloidal nature of Mo-blue.

W. R. A.

Mechanism of iron passivation in alkaline solutions of oxidisers. A. G. Samartzev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 206—209).— Fe rotated in a solution containing 800 g. of NaOH per l. with 5—25 g. of KNO_3 per l. is initially dissolved to give a solution of Na_2FeO_2 and $\text{Na}_2\text{Fe}_2\text{O}_4$ which deposits a film of Fe_3O_4 . The thickness and structure of the film depend on the temp., velocity of stirring, and concn. of the solutions. The KNO_3 may be replaced by KNO_2 .

F. R. G.

Formation and stability of oxide films. E. A. Gulbransen (*Trans. Electrochem. Soc.*, 1942, 82, Preprint 19, 209—221).—The existence, formation, and stability of oxide films on Fe , stainless steel, and Cr-Fe have been studied by a vac. micro-balance technique (B., 1942, I, 351). A low-temp. H_2 reduction method has been used to study the stability of films formed under various conditions. The air-formed film on pure Fe weighs 0.44 μg . per sq. cm., whilst the film formed in HNO_3 weighs 1.16 μg . per sq. cm. Clean degassed Fe reacts with O_2 at pressures as low as 10^{-6} atm. at room temp. and 3.3×10^{-7} atm. at 800°. Preliminary oxidation curves of the materials studied are given and discussed. The mechanism for Cr-Fe and stainless steel is similar to that for Fe . The H_2 -reduction method was unsuccessful with stainless steel at 600° and 800°. H_2O is adsorbed on clean Fe at room temp., giving a film stable to low pressure but not to 600°.

C. E. H.

New series of iridium sulphitochlorides. V. V. Lebedinski and M. M. Gurin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 36, 22—25).— $\text{Na}_3\text{IrCl}_6 \cdot \text{H}_2\text{O}$ with Na_2SO_3 yields, together with $\text{Na}_7\text{Ir}(\text{SO}_3)_4\text{Cl}_2 \cdot 7\text{H}_2\text{O}$, a new salt, $\text{Na}_5\text{Ir}(\text{SO}_3)_2\text{Cl}_4 \cdot 7\text{H}_2\text{O}$, which with RbCl gives $\text{NaRb}_3\text{Ir}(\text{SO}_3)_2\text{Cl}_3 \cdot 6\text{H}_2\text{O}$ (pentahydrate). The constitution of the complexes is discussed.

F. R. G.

X.—ANALYSIS.

Qualitative analysis of microgram samples. General technique and confirmatory tests. A. A. Benedetti-Pichler and M. Cefola (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 813—816).—The technique of working in a capillary cone (A., 1937, 635) has been extended to permit carrying out confirmatory tests after separation of the constituents of a group. Methods for identifying 0.001 μg . of the more common ions of group II are described.

L. S. T.

Volumetric determination of chlorides by method of Votoček and Trtilek. E. Bohm and O. Sturz (*Chemie*, 1942, 55, 319—320).—In the titration of Cl^- with $\text{Hg}(\text{NO}_3)_2$, using diphenylcarbazone as indicator, the end-point is indistinct, but in presence of Et_2O is indicated sharply by a change in the colour of the Et_2O layer from yellow-brown to intense red, due to formation of a red $\text{Et}_2\text{O-sol. Hg-diphenylcarbazone}$ complex in presence of excess of Hg^{++} .

R. J. W. R.

Determination of available chlorine in solutions containing Textone. See B., 1943, I, 63.

Colorimetric photo-electric determination of fluorine. P. Urech (*Helv. Chim. Acta*, 1942, 25, 1115—1125).—The sample is, if necessary, fused with NaOH , dissolved in H_2O (30 c.c.), and treated with conc. H_2SO_4 (35 c.c.) in a Claisen flask containing glass beads and ignited SiO_2 (0.5 g.). The solution is distilled until the temp. reaches 165°, when steam is blown in until 400 c.c. distil at a flask temp. of 165°. The distillate is treated with NaOH until alkaline to phenolphthalein, evaporated to 25 c.c., and steam-distilled again with HClO_4 (25 c.c.) at 135° until 400 c.c. of distillate are collected. This is diluted to 500 c.c. and an aliquot containing ≥ 4 mg. of F^- is treated with 5 c.c. of FeCl_3 -ferron reagent (saturated aq. 7-iodo-8-hydroxy-quinoline-5-sulphonic acid), 90 c.c., H_2O 100 c.c., and 0.1N- FeCl_3 in 2N- HCl 10 c.c.), diluted to 100 c.c., and its absorption compared photometrically with standards, using an RG2 filter.

J. W. S.

Zirconium-alizarin method of determining fluorine in natural waters. N. V. Tageeva (*J. Appl. Chem. Russ.*, 1942, 15, 56—60).—

De Boer's method (A., 1924, ii, 705) is applicable to solutions containing ≤ 0.2 mg. % of F⁻; the error is $\pm 5-10\%$. Cl⁻, SO₄²⁻, HPO₄²⁻, and AsO₄³⁻ interfere, and directions for the preliminary elimination of these ions are given. Naphthenic acids present in bore-waters do not interfere. R. T.

Detection of traces of moisture or oxygen in purified hydrogen.—See B., 1943, I, 63.

Iodometric determination of nitrogen in milk.—See B., 1943, III, 37.

[Analytical] control of ammonia in electrodeposition of brass.—See B., 1943, I, 73.

Analysis and preparation of "glacial metaphosphoric acid." I. Brown (*J. Proc. Austral. Chem. Inst.*, 1942, 9, 212—220).—Commercial "reagent metaphosphoric acid" contains PO₃' 30—55, P₂O₇' 25—40, PO₄' 0—5, and Na $\sim 13.5\%$, and is analysed by three-stage titration against NaOH (bromocresol-green, thymol-blue, addition of excess of AgNO₃, and Me-red). The commercial product was reproduced (PO₃' 55, Na 12%) by heating 89% H₃PO₄ with Na₃PO₄·8·4H₂O at 300—350° for 3 hr. in Au vessels. M. H. M. A.

Crude boron. Analysis and composition. E. H. Winslow and H. A. Liebafsky (*J. Amer. Chem. Soc.*, 1942, 64, 2725—2726).—Methods for the analysis of crude B by fusion and by rapid and slow chlorination are outlined. W. R. A.

Determination of carbon in low-carbon iron and steel.—See B., 1943, I, 72.

Separation of water-soluble salts by flotation. (Sodium, potassium, and ammonium salts.) A. Guyer and R. Perren (*Helv. Chim. Acta*, 1942, 25, 1179—1187).—The separation of Na, K, and NH₄ salts, suspended in a saturated aq. solution of the components, by the flotation method has been studied, using oleic acid (I) and Utinal V (decadecylsulphonic acid) (II) as flotation agents. In the separation of Na and K salts from NH₄ salts (I) causes passage of NH₄ into the foam whilst (II) leaves it in the residue. K is more readily separated from NH₄ than is Na. For separation of Na and K the best results are obtained with (II), which causes the Na to remain in the residue. Salts with common cations can also be separated by this method, the tendency to pass into the foam following the order SO₄²⁻ > NO₃⁻ > Cl⁻. The adsorption of (I) and (II) on NaCl and KCl has also been investigated. J. W. S.

Determination of calcium as oxalate.—See B., 1943, III, 40.

Determination of oxide copper [in ores].—See B., 1943, I, 63.

Detection of the mercuric ion in semimicro qualitative analysis. M. G. Burford and A. F. Wichrowski (*J. Chem. Educ.*, 1942, 19, 333—336).—A modification of Artmann's test (A., 1921, ii, 350) is described. The pptd. HgS is dissolved in hot conc. HI, the solution is evaporated just to dryness, 3N-HNO₃ added, and the solution again evaporated. A pink to scarlet deposit indicates Hg. The test is made more sensitive by adding Cu₂I₂, which gives a pink to dark-red deposit of Cu₂HgI₄. The comparative efficiencies of (NH₄)₂S_x, NaOH-NH₄Cl, and Sneed's NaHS reagent for separating group II into its sub-groups has been investigated. The presence of As and Sb, like that of Sn, favours dissolution of some of the HgS in (NH₄)₂S_x. L. S. T.

End-point of micro-titrations with colour indicators. A. A. Benedetti-Pichler and S. Siggia (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 828—832).—Solutions of concns. customary in macro-analysis are proposed for use in micro-titrations. The limitations resulting from the use of colour indicators in micro-titrations are discussed. In these titrations, light must travel approx. the same distance through the titrated solution as in macro-analysis if the concns. of indicator are identical. A sufficient thickness of layer (4 cm.) can be obtained in micro-procedures using vols. of ~ 0.1 ml. by observing the end-point in a capillary attachment to the vessel in which the titration is carried out. Recorded data show that in titrating NaOH with HCl (Me-red), and FeSO₄ with KMnO₄, the end-points are not recognised at the proper times when the titrations are carried out in centrifuge cones. Observation of colour changes occurring in a part of the titrated system is discussed for org. solvents used in determining the end-point in iodometric titrations. Details of procedure for using a droplet of CHCl₃ in iodometric titrations, and adsorption indicators in Ag titrations on a mg. scale, are given. L. S. T.

Morin as fluorescence indicator. E. A. Kocsis and G. Zádor (*Z. anal. Chem.*, 1942, 124, 42—45).—4—5 drops of 0.2% solution of morin in 50% EtOH serve as a fluorescence indicator for titrating NaOH with HCl, H₂SO₄, or HNO₃. In titrating alkali with acid in filtered ultra-violet light the yellowish-green colour suddenly fades (pH 8.0—9.8); this is followed by a second sudden change to emerald-green on adding more acid (pH 3.1—4.4). In titrating acid with alkali the colourless solution changes sharply to emerald-green (pH "8.0—9.8"), and then sharply to greenish-yellow (pH "3.1—4.4"). These changes enable alkali carbonate to be determined in presence of NaOH. Comparative data using phenolphthalein and Me-orange are recorded. L. S. T.

Determination of aluminium in manganese and aluminium bronzes, using the mercury cathode cell.—See B., 1943, I, 73.

Colorimetric determination of the aluminium content of magnesium alloys.—See B., 1943, I, 75.

Gravimetric determination of aluminium in magnesium alloys. Benzoate-oxine method.—See B., 1943, I, 75.

Photometric determination of manganese in manganese bronze.—See B., 1943, I, 73.

New fluorescence indicators. E. A. Kocsis and E. Pettkó (*Z. anal. Chem.*, 1942, 124, 45—47).—*o*-OMe·C₆H₄·CHO (I), *o*-C₆H₄(NH₂)₂·2HCl, and *p*-C₆H₄(NH₂)₂ in 0.2% aq. or EtOH solution can be used as fluorescent indicators for titrating NaOH with aq. HCl or aq. H₂SO₄, but not aq. HNO₃, in filtered ultra-violet light. The colour changes are green to colourless, orange-yellow to colourless, colourless to green, respectively. The reverse changes occur on titrating acid with alkali. The pH range is 3.1—4.4. The aq. solution of (I) showed no change after 5 months. Typical data are recorded. L. S. T.

Colorimetric determination of cobalt as the cobalt thiocyanate complex. B. Mader (*Chemie*, 1942, 55, 206—207).—The sample containing 0.001—0.1 g. of Co is made slightly alkaline with NaOH, just acidified with H₂SO₄, and treated with 6—8 g. of Na₄P₂O₇. After adding NH₄CNS (6—8 g.) the solution is extracted with 7 c.c. of C₅H₁₁·OH-Et₂O (1:7). After addition of more NH₄CNS and further extraction with C₅H₁₁·OH-Et₂O the combined extracts are diluted to 25 c.c. and the colour intensity is measured in conjunction with an S61 filter. The error of the method is 1—2%. For higher [Co] (0.3—20%) the colour produced in COMe₂ solution can be used with advantage. For this purpose Fe, Cr, W, and Mo are pptd. by boiling the solution with ZnO. An aliquot portion of the filtered solution is made up to 20 c.c., treated with 50% HNO₃ (0.1 c.c.), 2% aq. NaF (2 drops), and 50% KCNS (5 c.c.), and diluted to 50 c.c. with COMe₂. The colour of the resulting solution is measured photometrically in conjunction with a red OG2 filter. J. W. S.

Determination of cobalt and manganese by photometric methods. L. Waldbauer and N. M. Ward (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 727—728).—Co in presence of Mn ($\geq 99.4\%$) is determined photoelectrically (green filter) using a CHCl₃ extract of the compound with 1:2-NO·C₁₀H₈·OH. Mn is determined in presence of Co ($\geq 99.5\%$), by pptn. as MnNH₄PO₄·H₂O and subsequent conversion into the Mn-CH₂·N·OH compound, which is evaluated photometrically. Procedure, standardisation curves, and test data are given. L. S. T.

Analysis of tin-base bearing metal. Permanganate and iodometric methods for antimony and copper.—See B., 1943, I, 74.

Colorimetric determination of titanium in chromium steels. Separation of titanium and chromium by perchloric acid.—See B., 1943, I, 72.

Colour reactions for thorium, uranium, and other elements. V. I. Kuznetsov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 898—900).—The effect of various groupings on the production of coloured compounds with sp. elements, thus providing colour tests for these elements, is discussed. The colours produced by some *o*-arsonic acids of *o*-hydroxyazo-compounds with rare earths, Ti, Zr, Sn, Th, Nb, Ta, and U are given. By adjustment of pH it is possible to increase the specificity of the reaction. The presence of AsO₃H₂ *ortho* to the azo-group is essential for the production of colour. The sensitivity in the case of Th or U is sufficient to give a colour change with solutions of 1 p.p.m. A. J. M.

Determination of germanium in silicate rocks. A. G. Hybbinette and E. B. Sandell (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 715—716).—The rock sample is decomposed by means of H₂SO₄-HNO₃-HF. HF is removed by evaporation, followed by dilution and distillation at 140° with a current of air passing through the solution to remove the last traces of HF. Ge is then distilled as GeCl₄, and determined colorimetrically in the distillate by means of the blue colour formed with FeSO₄ and NH₄ molybdate. Interference by As is not serious in samples for which the method is intended. 0.0001% Ge can be detected with certainty in a 1-g. sample. Details of procedure and typical data are given. L. S. T.

XI.—APPARATUS ETC.

Device for improving temperature regularity in laboratory tube furnaces. H. Florenz (*Aluminium*, 1940, 22, 351—352).—By enclosing the working tube and heating element in a wide Fe tube with air insulation the temp. of an electric tube furnace can be held const. to $\pm 1^\circ$ over the middle 20 cm. and to $\pm 5^\circ$ over 34 cm. when the total length is 60 cm., i.e., the range of uniform heating is about doubled. A. R. P.

X-Ray high-temperature camera. A. de Bretteville, jun. (*Rev. Sci. Instr.*, 1942, 13, 481—483).—The camera, for use at $> 300^\circ$, includes a concentric heater, a small Fe-constantan thermocouple, and a cooled jacket to protect the film. The sample may be rotated at 1 r.p.m. A. A. E.

Turbidity measurement by optical means. E. G. Richardson (*Proc. Physical Soc.*, 1943, 55, 48—63).—A lecture. N. M. B.

Crystal rotating device for use on a fibre spectrometer. F. Happey and A. W. Porter (*J. Sci. Instr.*, 1943, **20**, 15).—By means of a device whereby a spindle carrying the crystal is rotated stepwise by a stop-watch mechanism the unit of translation along the crystal axes of rotation can be estimated. A. A. E.

Improvement in design of the concave grating spectrograph. G. P. Brewington (*Rev. Sci. Instr.*, 1942, **13**, 501—502).—The housing is large; the central image can be observed on a screen on the circle and an adjustable shutter cuts off only that portion of the light which would reach the photographic plate. A. A. E.

Automatic timing device for spectrographic exposures. G. Balz (*Aluminium*, 1940, **22**, 344—345).—A device for automatically regulating preparking periods and exposure times in routine spectrographic analysis is illustrated and briefly described; it consists of a series of relays operated by a synchronous motor at pre-arranged intervals, and signal lamps to indicate the progress of a cycle of operations. A. R. P.

New type of microphotometer. R. Fürth (*Proc. Physical Soc.*, 1943, **55**, 34—41).—The instrument described shows the blackening curve, corresponding with the distribution of blackening along a straight line on a photographic plate or film, instantaneously on the fluorescent screen of a cathode-ray oscillograph. The curve can be measured directly on the screen or photographed for later use. N. M. B.

Subjective homochromic solution to the problem of heterochromic photometry. P. Fleury (*Compt. rend.*, 1942, **214**, 706—707).—A method of obtaining more accurate results in the photometry of different coloured lights is outlined. A. J. M.

Measurement of the blackening of spectral lines with a logarithmic galvanometer scale. G. Balz (*Aluminium*, 1940, **22**, 343—344).—Blackening of spectral lines on the photographic plate is a logarithmic function of the current of a photo-cell which is \propto the incident light; by using a logarithmic scale with the galvanometer (construction and calibration are described) the difference in blackening of two lines is simply the difference between two numerical vals. A. R. P.

Photo-electric polarimeter. G. Bruhat, A. Blanc-Lapierre, J. Schiltz, and G. Raoult (*Compt. rend.*, 1942, **214**, 615—617).—Modifications to increase the sensitivity of the Bruhat-Guinier amplifier are described. L. J. J.

Niobium foil as a filter for Mo $K\beta$ radiation. L. K. Frevel and H. W. Rinn (*Rev. Sci. Instr.*, 1942, **13**, 504).—Intensity reductions for Mo $K\alpha$ and $K\beta$ lines have been measured. White radiation on the long- λ side of the Nb K edge produced definite spectra from those crystal planes giving intense Mo $K\alpha$ reflexions. For crystal diffraction work Zr is superior to Nb as a filter for Mo $K\beta$ radiation. A. A. E.

Electronic method of measuring molecular lifetimes. R. D. Rawcliffe (*Rev. Sci. Instr.*, 1942, **13**, 413—418).—Apparatus (an electron multiplier tube and a cathode-ray oscilloscope) employed to follow changes in light intensity occurring in times $\sim 1 \mu\text{sec.}$ has been used to measure the decay of fluorescence of Ac_2 vapour and that of light from a N_2 discharge. The mean lifetime of the fluorescence of Ac_2 vapour is 1.40×10^{-3} sec. The blue N_2 system decays exponentially with mean lifetime 7.7×10^{-6} sec.; the decay of the red system can be resolved into 2 exponentials, with mean lifetimes 29×10^{-6} and 1.5×10^{-6} sec., respectively. A. A. E.

Application of guard electrodes in dielectric measurements. E. W. Greenfield (*Rev. Sci. Instr.*, 1942, **13**, 489—492).—A brief survey. A construction drawing of a cylindrical, guarded cell suitable for immersion is reproduced. A. A. E.

Modified calomel cell for pH measurements. A. D. E. Lauchlan and J. E. Page (*Nature*, 1943, **151**, 84).—For routine determinations in which the highest accuracy is not required, NaCl can replace KCl. The potential of the cell is 245.8 mv. at 20° . A. A. E.

Apparatus for measurement of scattering of low-velocity ions in gases at low pressure. J. H. Simons, H. T. Francis, C. M. Fontana, and S. R. Jackson (*Rev. Sci. Instr.*, 1942, **13**, 419—426).—By means of the apparatus consisting of an ion source, focussing devices, a magnet for selection, and a measuring chamber, ion neutralisation as well as elastic scattering can be determined as a function of velocity. A. A. E.

Inefficiency and other sources of error in cosmic ray measurements with self-quenching counters. K. Greisen and N. Nereson (*Physical Rev.*, 1942, [ii], **62**, 316—329).—Errors due to inherent inefficiency (A) and to inefficiency (B) arising from showers and scattering have been measured. A is due almost entirely to the dead time and is $\sim 0.2\%$ for counters with a normal counting rate of 300 per min. Data for B under various conditions are given and discussed. N. M. B.

Electronic liquid level indicator. S. C. Coroniti (*Rev. Sci. Instr.*, 1942, **13**, 484—488).—The liquid, conducting or not, occupies the inner space of a coaxial cylindrical condenser. As the level varies, the change in capacitance detunes a resonance, resulting in a change of plate current through the oscillator tube. A. A. E.

Simple thyatron circuit. S. Golden (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 812). L. S. T.

Polarographic technique. A. Dravnieks and M. Straumanis (*Z. anal. Chem.*, 1942, **124**, 31—34).—A new form of dropping cathode, a simple cathode mounting, and a small anode vessel are described. L. S. T.

Electron microscopy with electrostatic lenses. H. Mahl (*Z. tech. Physik*, 1942, **23**, 117—119).—An improved electron microscope is described. W. R. A.

Stereoscopic measurement of objects with the electron microscope. E. Gotthardt (*Z. Physik*, 1942, **118**, 714—717).—Formulæ are advanced for the determination of the space co-ordinates of points from electron-microscope images. A. J. M.

Effect of crystal lattice interferences on the image produced by the electron microscope. H. Boersch (*Z. Physik*, 1942, **118**, 706—713).—Shadow electron-microscope photographs show that the black lines observed in the bright-field photographs of thin crystals are due to weakening of the primary beam by lattice interferences and are independent of the orientation of the crystal. A. J. M.

Applications of mass spectrometric analysis to chemistry. D. Rittenberg (*J. Appl. Physics*, 1942, **13**, 561—569).—A review of the use of radioactive and stable N and O isotopes as tracers in biochemistry. L. J. J.

Ultracentrifuge. D. A. MacInnes (*Ann. New York Acad. Sci.*, 1942, **43**, 175—176).—Introduction to the Conference, Nov., 1941. The "Svedberg" ($S = 10^{-13}$ abs. units) is adopted as the practical unit for sedimentation consts. N. M. B.

Optical problems of the ultracentrifuge. W. B. Bridgman and J. W. Williams (*Ann. New York Acad. Sci.*, 1942, **43**, 195—210).—A discussion of the methods, based on changes in optical properties, for following the redistribution of components during sedimentation in an ultracentrifuge. N. M. B.

Integration of the differential equation of the ultracentrifuge. W. J. Archibald (*Ann. New York Acad. Sci.*, 1942, **43**, 211—227).—Mathematical. N. M. B.

Production and maintenance of high centrifugal fields for use in biology and medicine. J. W. Beams (*Ann. New York Acad. Sci.*, 1942, **43**, 177—193).—The following types of ultracentrifuges are described and discussed: the Svedberg oil-driven type, the gas-driven type, the air-driven vac. type, and the electrically-driven magnetically supported vac. type. N. M. B.

Ultracentrifuge cell. E. G. Pickels (*Rev. Sci. Instr.*, 1942, **13**, 426—434).—Improvements include the strengthening of parts, the use of a duralumin centrepiece, provision for alignment, and an arrangement for orienting the windows. A. A. E.

Micro-scale extractions by organic solvents. P. F. Holt and H. J. Callow (*J.S.C.I.*, 1943, **62**, 32).—An apparatus for the extraction with immiscible org. solvents of small quantities (8 to 100 c.c.) of aq. solutions which easily emulsify on shaking is described.

Viscosity tonometer. New method of measuring tension in liquids. R. S. Vincent (*Proc. Physical Soc.*, 1943, **55**, 41—48).—The gas-free liquid is enclosed in a glass bulb to which is connected a fine capillary tube. By controlled cooling of the bulb, tension is created and pulls the column of liquid down the capillary tube. The highest rate of flow which does not cause a break in the liquid is observed and the corresponding tension calc. Illustrative results are given. N. M. B.

Recording viscosimeter for paint-consistency measurements.—See B., 1943, II, 57.

Simple rotary viscometer for the study of anomalous viscous properties. J. N. Mukherjee and N. C. S. Gupta (*Indian J. Physics*, 1942, **16**, 66—70).—Apparatus is described. O. D. S.

Velocity gradient method for measurement of viscous properties of non-Newtonian liquids. J. N. Mukherjee and N. C. S. Gupta (*Indian J. Physics*, 1942, **16**, 49—53).—The velocity gradient in a flowing liquid is determined directly by microscopic observation of the motion of suspended particles at different depths in the liquid. Curves for sugar solution (Newtonian liquid), gelatin sols, and a bentonite suspension are discussed. O. D. S.

Methods of measuring yield value, viscosity, and thixotropy. J. N. Mukherjee, N. C. S. Gupta, and K. C. Sen (*Indian J. Physics*, 1942, **16**, 54—65).—Although the capillary and rotary viscometers give similar viscosity- and yield val.-conc. curves for bentonite suspensions, the Bingham yield vals. and viscosity differ according to the method of measurement. Vals. obtained by the velocity gradient method (cf. preceding abstract) agree more closely with those obtained by the rotary viscometer. Variations in the lower yield val. and apparent viscosity of thixotropic suspensions with time have been observed. O. D. S.

Beryllium-copper and its applications. D. W. Crossley and E. M. Foster (*J. Sci. Instr.*, 1943, **20**, 7—9).—Be-Cu alloys are non-magnetic and show great freedom from sparking; they are especially suitable for springs, but should not be used in presence of S or halogens. Properties and manipulation are summarised. A. A. E.

Rigid stands for laboratory apparatus. L. J. Wheeler (*J. Sci. Instr.*, 1943, 20, 15—16).—The use of electricians' conduit, preferably threaded for use with standard joints, is illustrated. A. A. E.

Short open-tube manometer for vacuum systems. S. C. Brown (*Rev. Sci. Instr.*, 1942, 13, 503—504).—Fritted glass discs sealed in the U-tube permit the flow of gas but not Hg, which when in contact with the disc forms a vac. seal. A gas release may be provided by including a bulb to prevent sealing on the side remote from the vac. system. A. A. E.

Efficient column suitable for vacuum fractionation. Concentric tube type. S. A. Hall and S. Palkin (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 807—811). L. S. T.

Constant-level device for hot water baths [using distilled water]. B. W. Pocock (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 811—812). L. S. T.

Carbon dioxide generator [using dry-ice]. J. A. Johnston (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 805). L. S. T.

Removal of adsorbents from chromatographic tubes. J. Turkevich (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 792). L. S. T.

Enclosed laboratory apparatus for effecting repeated crystallisations from solvents. J. D. Piper, N. A. Kerstein, and A. G. Fleiger (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 738—739). L. S. T.

Apparatus for crystallisation and filtration at low temperatures. F. W. Quackenbush and H. Steenbock (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 736—737). L. S. T.

Flask design and high-speed stirring. A. A. Morton, B. Darling, and J. Davidson (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 734—736; A., 1942, I, 75).—Improved apparatus for high-speed stirring is described. Results of a comparison of an ordinary flask, a creased flask, and the apparatus of Huber and Reid (B., 1926, 519), using the oxidation of $p\text{-C}_6\text{H}_4\text{Me}\cdot\text{NO}_2$ as a guide, are recorded. L. S. T.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Henry Cavendish. M. Schofield (*Chem. and Ind.*, 1943, 41—42).

Newton's chemical philosophy. D. McKie (*Phil. Mag.*, 1942, [vii], 33, 847—870).

Joseph Black (1728—1799). A. Kent (*Chem. and Ind.*, 1942, 530—531).

John Roebuck. K. R. Webb (*Chem. and Ind.*, 1942, 533—534).

Early history of strontium. J. R. Partington (*Ann. Sci.*, 1942, 5, 157—166).

Origin of the thermometer. F. S. Taylor (*Ann. Sci.*, 1942, 5, 129—156).

Bernardo Oddo (1882—1941). Q. Mingoia (*Gazzetta*, 1941, 71, 737—752).—An obituary notice, with bibliography. E. W. W.

History of isotopes and measurement of their abundances. E. B. Jordan and L. B. Young (*J. Appl. Physics*, 1942, 13, 526—538).—A survey of published work. L. J. J.

XIII.—GEOCHEMISTRY.

Fluorine and boron in natural waters, and their bearing on the occurrence of petroleum. N. A. Tageeva (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 34, 117—129).—F, B, and P (As) contents of various natural waters (Caucasian) are tabulated, and discussed in relation to the origin of the water and relationship to oil deposits. L. S. T.

Distribution of boron in the waters of Azerbaidjan oilfields and its correlational value. L. A. Guliaeva (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 71—75).—B distribution in H_2O from Baku petroleum layers increases regularly with depth and accumulation of B is not associated with accumulation of Cl. High B content is associated with alkaline H_2O . $[\text{B}]/[\text{Cl}]$ is a good correlative for the three sections of the productive layer; in mud-volcanoes it indicates the H_2O -bearing horizons pierced by the volcano. L. J. J.

Occurrence of copper in oil-field waters. E. S. Itkina (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 149—152).—Cu is found in most samples of edge- H_2O from oil-fields and mud-volcanoes of Azerbaidjan, but not in those of the second Baku. A. J. M.

Occurrence of strontium and barium in oil-field waters of the Ural-Volga region. A. A. Varov and I. I. Romm (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 114—117).—All oil-field waters in this area contain Sr, but only waters from the Devonian regions contain Ba. The content of Sr depends on the $[\text{SO}_4^{2-}]$ of the H_2O , the chemical characteristics of the H_2O , and the degree of mineralisation. A. J. M.

Salt reserves of Lake Ebeitz. I. G. Drushinin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 901—902).—The salt deposited in Lake Ebeitz (Omsk region) when the lake is frozen consists chiefly of $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ (I). Salts deposited by sedimentation consist of (I) (92.89%), NaCl (1.32%), MgSO_4 (0.30%), and $\text{Ca}(\text{HCO}_3)_2$ (traces).

In autumn and winter, the newly pptd. (I) covers the bottom of the lake to a depth of 25—30 cm. The bed of the lake consists chiefly of (I) (mirabilite). A. J. M.

Iron content of marine river-deposits. C. Francis-Bœuf (*Compt. rend.*, 1942, 214, 279—282).—Data for three river estuaries are given, and the fine semi-colloidal deposits, which contain an important proportion of FeS or FeS_2 , are discussed with reference to their function as a binding material for larger particles, colour, relation to org. matter, and variation with geographical conditions. N. M. B.

Segregation of secondary quartz in the lower Permian deposits of Tatana. L. M. Miropolski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 36, 62—65).—Examination of these deposits shows the widespread presence of SiO_2 as individual grains or crystals, intergrowths, and aggregates and in cavities in other rocks. The mechanism by which this concn. of Si as SiO_2 has occurred is discussed. J. W. S.

Study of bent quartz crystals by means of a Cauchois spectrograph. E. Vainshtein (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 34, 107—109).—The general picture of deformation observed in mica is reproduced in its main features in crystals of quartz. The phenomenon described by Watson (A., 1938, I, 99) should be accounted for by the breaking of the crystal into separate pieces. L. S. T.

X-Ray spectrographic investigation of bent mica crystals with the aid of a Johann spectrograph. E. Vainshtein (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 233—235).—Spectrographic examination of bent mica crystals shows that in the action of bending the crystals are split into smaller crystals, the latter changing their orientation one to another without being individually distorted to any appreciable extent. C. R. H.

Fossilisation of diatoms in Tertiary flints of Oran. G. Deflandre (*Compt. rend.*, 1942, 214, 319—322).—New features of diatom fossilisation are described. F. O. H.

New diagram for the determination of plagioclase twins. A. N. Zavaritsk (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 36, 14—16).—The anorthite and twinning law of a plagioclase can be determined using the five-axial universal stage by direct measurement, without graphical construction. F. R. G.

Binary system CaSiO_3 -diopside and the relations between CaSiO_3 and akermanite. J. F. Schairer and N. L. Bowen (*Amer. J. Sci.*, 1942, 240, 725—742).—Data from quenching experiments are recorded for these two systems, and results are represented diagrammatically. The bearing of these results on the chemical compositions of certain rock-forming minerals, and on their melting and stability relationships is discussed. L. S. T.

System CaSiO_3 -diopside-anorthite. E. F. Osborn (*Amer. J. Sci.*, 1942, 240, 751—788).—New data obtained by the quenching method are presented; the phase relationships are discussed by means of diagrams. A ternary reaction point occurs at 1245° , and the lowest temp. at which liquid exists in the system under equilibrium conditions is 1236° . The compound $5\text{CaO}\cdot 2\text{MgO}\cdot 6\text{SiO}_2$ does not appear in this system; data supporting the view that it does not exist are given. Additional data for the limiting systems CaSiO_3 -anorthite (I) and diopside-(I) are recorded. L. S. T.

Macrofibrous anhydrite in the Chuvash Republic. L. M. Miropolski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 157—158).—An analysis of a macrofibrous anhydrite is given. A. J. M.

"Age" of terrestrial matter and the geochemical uranium : lead ratio. F. F. Koczy (*Nature*, 1943, 151, 24).—Revised calculations give 5.33×10^9 years as the max. age of terrestrial matter and 5.6 for the geochemical Pb : U ratio. A. A. E.

Principal stages in the history of indium in the earth's crust. N. M. Prokopenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 903—906).—The geochemical history of In may be reduced to the stages: magmatic, pegmatitic, pneumatolytic, contact, hydrothermal, and hypogene. In is not typical of the magmatic stage, and occurs largely disseminated. It occurs only in small concns. in pegmatites and pneumatolytic deposits. The skarn deposits (contact type) of the U.S.S.R. often contain reasonable concns. of In. It occurs in the largest concn. in hydrothermal deposits (e.g., Sn and W minerals). It seldom accumulates in the hypogene stage in large amounts. A. J. M.

Migration of ionium under natural conditions. I. E. Starik and O. S. Melikova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 911—913).—The Io content of carnotite with an isomorphous admixture of tyuamunite has been determined. Although the migration of Ra from the mineral is considerable, the Io content is relatively near its equilibrium val. A. J. M.

Age of pyroxenite intrusions of Afrikanda and Ozernaja Varaca in the Kola Peninsula. E. K. Gerling and I. E. Starik (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 153—154).—Two shorlomite specimens from the above intrusions were investigated, their content of He, Ra, and Th being determined. The two intrusions were formed simultaneously $\sim 340 \times 10^6$ years ago. A. J. M.

"Friable" bauxites and the cretaceous crust of bauxite weathering in the Sokolov deposit of the Kamensk (Central Urals) region. B. P.

Krotov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 76—78).—Friable structure in the upper layers of bauxite beds is due to weathering in continental periods. Abnormal Si contents in friable bauxites are associated with the nature of overlying sedimentary rocks. L. J. J.

Development of Tartarian lower Permian red rocks of the "red bed" type and the causes of their colour. L. M. Miropolski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 210—213).—The green and red colouring of the interbeds of argillite, silstone, marl, and breccia in the Kungurian deposits along the Kama river (Tartar Republic) is attributed to oxides and hydrated oxides respectively of Mn and Fe. F. R. G.

Metamorphism and assimilation in the Wellington District, N.S.W. II. Dynamic and contact metamorphism of a group of ultrabasic rocks. E. M. Basnett (*J. Proc. Roy. Soc. New South Wales*, 1942, **76**, 55—81).—Petrological. Chemical analyses of 9 rocks are recorded. L. S. T.

Rock deformation and mineralisation at Mount Isa. R. Blanchard and G. Hall (*Proc. Austral. Inst. Min. Met.*, 1942, No. 125, 1—60).—The rock deformational and mineralisation processes responsible for ore deposition in the Mount Isa Ag—Pb—Zn deposit are described, and supported by data relating to (i) replacement by the mineral sulphides, (ii) mineralogical composition of the Ag—Pb—Zn ore bodies, and (iii) mineralogical composition of the central mineralised block at Mount Isa. Analyses of typical Mount Isa pyrite are given. L. S. T.

Spectral analysis of celestite from the Upper Permian deposits of Tataria. L. M. Miropolski and S. A. Borovik (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 114—116).—Of the 37 elements sought in 6 samples only 11, viz., Mg, Al, Si, Ca, Ti, V, Fe, Cu, Y, Ba, and Sr, were found. The composition of crystals is essentially the same for different stratigraphical horizons, and no relation between chemical composition and variation in habit and shape of the crystals could be established. The Si, Ba, Ca, and Ti contents are high and variable. Mg, Fe, Al, V, Cu, and Y are present in traces only. Si and Fe appear to be part of the lattice of celestite, and Ti and Fe characterise its colour. L. S. T.

Subdivision of colloid-dispersed minerals of the montmorillonite group. I. D. Sedletzki (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 130—133).—Examination of montmorillonite (I) clays shows that (I) is not an individual mineral, but consists of a group of closely-related minerals of different compositions; these are recorded. L. S. T.

Mineralogy of lower cretaceous deposits of Kislovodsk [Lower Caucasus]. S. G. Sarkisian (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 284—287).—The results of a detailed mineralogical analysis of cretaceous deposits at Kislovodsk are described. The deposits are considered to be local in origin. C. R. H.

Morphology of idocrase. J. A. Tremblay (*J. Washington Acad. Sci.*, 1942, **32**, 327—337).—Analysis by Donnay's method assigns the space-group $C4/acn$ with $c : a = 0.5372$ to idocrase. After turning through 45° , the space-group becomes $P4/nnc$ with $c : a = 0.7597$. The data, which agree with those obtained by X-rays, are discussed with reference to Bravais' law and to Friedel's law of mean indices. C. R. H.

Nordite, a new mineral of the Lovozero tundras. V. I. Gerasimovskii (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 496—498).—Nordite occurs as light-brown lamellae, $a : b : c = 0.730 : 1 : 0.527$. Cleavage is marked along (100); hardness 5—6, sp. gr. 3.430, n_D 1.642, n_m 1.630—1.640, n_p 1.619. X-Ray data show it to be rhombic. The empirical formula is $2Na_2O, 3(Sr, Ca, Mn, Mg)O, 0.7(La, Di, Y)_2O_3, 8SiO_2$. Of the individual rare earths, nordite contains La_2O_3 8.55%, Ce_2O_3 8.1%, Pr_2O_3 1.6%, Nd_2O_3 1.85%. It is found in pigmatites between sodalite grains. L. J. J.

Villiaumite from Lovozero tundras. V. I. Gerasimovskii (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 492—495).—Villiaumite (essentially NaF) occurs in interstices of lovozerite as carmine-red grains, n_{6200} 1.3253, n_{6000} 1.3258, n_{5800} 1.3268, n_{5200} 1.3272. The X-ray spectrum agrees with NaF. It is found associated with sodalite-syenite and luyavrite, and is probably widely distributed in the Lovozero and Chibiny massifs. L. J. J.

Method of colour-photomicrographs in the ultra-violet as applied to determination [detection] of silver in thin [mineral] sections. E. M. Brumberg and M. V. Schevtschenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 486—488).—Micro-inclusions of Ag in mineral sections are photographed by reflected light with the Hg line 3130 Å., isolated by the filters described, which corresponds with a reflexion min. of Ag. Reflexion microscopic objectives are used. L. J. J.

Colloid-dispersion mineralogy, its problems and methods. I. D. Sedletzki (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 165—170).—From a review of the results of recent work on the genesis of highly dispersive formations, e.g., soils, loesses, clays, muds, the following five laws of colloid-dispersion mineralogy are enunciated: (1) the composition of these minerals is governed solely by the character of the weathering process, (2) the composition of the minerals

formed by weathering of different rocks represents paragenetic association of argillites determined by the weathering conditions, (3) the paragenesis of elements forming such fractions depends on the paragenesis of colloid-dispersive minerals, (4) the genesis of the minerals is linked up with the conditions of the medium, e.g., montmorillonite-type minerals are formed under neutral or alkaline conditions, and kaolin-type under acid conditions, (5) the weathering of rocks passes through a series of stages the duration of which is determined by physico-geographical and climatic conditions. A. R. P.

Dolomitisation of reefagenic formations in the oil-bearing region of Ishimbaevo. G. I. Theodorovitsch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 160—164).—Evidence is adduced to show that the dolomitisation of limestone by aq. $MgSO_4$ ceases when the solution becomes saturated with $CaSO_4$ and that saturated $MgSO_4$ solution is not necessary to complete the process. When the $CaSO_4$ is deposited in the dolomite and subsequently leached out a porous dolomitic limestone or dolomite remains; this is the case at Ishimbaevo, where petrographic examination of the rocks indicates that both dolomitisation and sulphatisation of the original limestone deposits took place under extreme conditions at the bottom of shallow bays or other H_2O reservoirs. Subsequently when the reefs were covered by the H_2O of the Kungurian basin all the free cavities were rapidly filled with fine-grained anhydrite. A. R. P.

Thermal characteristics of humic acids. I. D. Sedletzki and G. V. Schmakova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 255—257).—Thermographs of humic acids from peat and soil show similar characteristics, viz., endothermic interval $90—100^\circ$ due to separation of hygroscopic H_2O , exothermic interval $200—400^\circ$ possibly due to combustion of certain ingredients, endothermic interval $630—635^\circ$ due to separation of H_2O as a result of transformation of CO_2H , OH , and OMe groups, exothermic interval $770—860^\circ$ due partly to burning of bituminous substances, and a complex exothermic effect at 1100° when humic acids decompose. The data support those obtained by X-ray and electronographic methods. C. R. H.

Modern conceptions of the physical constitution of coal and related research in Great Britain. C. E. Marshall (*J. Geol.*, 1942, **50**, 385—405).—No essential differences exist between the normal coal types and constituents of American and British Carboniferous coals. The importance of petrographic analysis in the economic and efficient utilisation of coal, and of petrographic examination of the mineral matter in coal seams in solving problems of prep. and treatment, is emphasised. L. S. T.

Relation of the physical constitution of coal to its chemical characteristics. H. H. Lowry (*J. Geol.*, 1942, **50**, 357—384).—Mainly a review of published data on the chemical nature of the banded constituents of coal seams. L. S. T.

Physical constitution of coal as related to coal description and classification. E. C. Dapples (*J. Geol.*, 1942, **50**, 437—450).—A discussion of the interrelationship of primary coals shows that no sharp boundary exists between banded and non-banded varieties, and that all are part of the same series of composite coals. L. S. T.

Influence of physical constitution of coal on its chemical, hydrogenation, and carbonisation properties. G. C. Sprunk (*J. Geol.*, 1942, **50**, 411—436).—Correlation between microstructure and the chemical, carbonisation, and hydrogenation properties of coal shows that microstructure must be considered whenever differences in coal properties are to be explained. The type of coal and the kind of constituents have considerable effect on the ultimate and proximate analysis. Relationships established between the analysis of coals and the yields of carbonisation products are given. The O content of bright coals correlates satisfactorily with the agglutinating val. of the coal. L. S. T.

Optical reflexions from coal. C. G. Cannon and W. H. George (*Nature*, 1942, **150**, 690).—Max. variations in ash content, volatile matter, and sp. gr. exhibit overlap between coal constituents, but measurements of % specular reflexion at polished surfaces at 60° angle of incidence and reflexion are characteristic for durain (2—4) and vitrain (5.7—15.7). The spreading of the reflected beam is in the order fusain > durain > vitrain. A. A. E.

Distribution of nickel and copper in the caustobiolites of Tataria. L. M. Miropolski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **35**, 155—156).—Ni and Cu are always present in the ash of any kind of caustobiolites (coal, peat, oil, asphaltite, etc.) but the amounts in these substances in the Tataria district are very small. Coals appear to contain more Ni and Cu than other substances of this type. A. J. M.

Sulphur as an indicator in prospecting for oil, on the evidence obtained in the region of Sterlitamak-Ishimbaevo. G. I. Teodorovitsch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 121—125).—When accompanied by bitumens, gaseous, liquid, or solid, or their traces, native S indicates the presence of oil at lower horizons. L. S. T.

APRIL, 1943.



I.—SUB-ATOMICS.

Calculation of atomic terms. P. Gombás (*Z. Physik*, 1942, 119, 318—324).—Mathematical. L. J. J.

Theory of complex spectra. II. G. Racah (*Physical Rev.*, 1942, [ii], 62, 438—462; cf. A., 1942, I, 221).—Mathematical. The spectra of two-electron configurations in (*jj*) and (*jl*) coupling and of the configurations d^n , f^3 , d^2p , and d^3p in *LS* coupling are calc. with tensor operators. The agreement with the odd terms of Ti II and Ni II is satisfactory. N. M. B.

Classical field theory. A. C. Menius, jun., and N. Rosen (*Physical Rev.*, 1942, [ii], 62, 436—437).—Development of a theory previously proposed (cf. A., 1939, I, 176) shows that it is not capable of accounting for the Sommerfeld fine-structure const. N. M. B.

$s^2p^4\ ^1S$ and $sp^5\ ^1P$ in the Si iso-electronic sequence. B. Edlén (*Physical Rev.*, 1942, [ii], 62, 434—435; cf. Boyce, A., 1936, 537).—The correct identification of the strong line in the extreme ultra-violet spectrum of the series Cl—Sc is $s^2p^4\ ^1D$ — $sp^5\ ^1P$. The former combination appears to be faint, but its location in Si, Cl II, A III, and K IV is provisionally deduced from an examination of available data. N. M. B.

Term analysis of the third spectrum of iron (Fe III). B. Edlén and P. Swings (*Astrophys. J.*, 1942, 95, 532—554).—The Fe III spectrum in the region 300—6500 Å. was measured and analysed. 32 of the possible 34 terms of the $3d^6$ configuration were found, with 64 of the possible 74 terms of the $3d^5\ 4s$ configuration, and a corresponding no. for the $3d^5\ 4p$ configuration. 320 levels and ~1500 lines are tabulated. The rôle of permitted and forbidden transitions of Fe III in stellar and nebular spectra is discussed. E. R. R.

Spectroscopic observations of 17 Leporis. B. Smith and O. Struve (*Astrophys. J.*, 1942, 95, 468—488).—142 observations between 1928 and 1942 show 9 non-periodic outbursts, each accompanied by large violet-displacements of the sharp lines of H, Fe II, Ti II, Fe I, Sr II, Ca I, Ca II, Cr II, and Sc II. Lines of the reversing layer (H, Mg II 4481, and Si II) are not masked during these outbursts. The strongest metallic lines sometimes show weak emission borders on their red sides. E. R. R.

Spectrum of BD + 11° 4673 during the years 1937—41. P. W. Merrill (*Astrophys. J.*, 1942, 95, 386—401).—A detailed résumé of particular and progressive changes in the spectrum since 1915 is given, and the expanding atm. hypothesis is briefly discussed in the light of these changes. E. R. R.

Spectra of ten gaseous nebulae. A. B. Wyse (*Astrophys. J.*, 1942, 95, 356—385).— $\lambda\lambda$, estimated intensities, and probable identifications of faint nebular lines in nine planetaries and the Orion nebula are tabulated. Additional evidence of metallic elements, especially Fe II and Fe III, in nebulae is given. Close similarity in chemical composition is observed in all the objects investigated, and earlier conclusions as to the relative abundances of the elements are confirmed. E. R. R.

Spectrographic orbit of the companion to Rigel. R. F. Sanford (*Astrophys. J.*, 1942, 95, 421—424).—The orbit, determined from 18 spectrograms, is nearly circular. Period = 9.860 days; $m_2/m_1 = 0.767$; $(a_1 + a_2) \sin i = 7.771 \times 10^6$ km.; $\gamma = +19.1$ km. per sec. E. R. R.

Spectrographic orbit of 42 Capricorni. R. F. Sanford (*Astrophys. J.*, 1942, 95, 425—427).—E. R. R.

Absolute dimensions of a Wolf-Rayet star and the expanding envelope hypothesis. O. C. Wilson (*Astrophys. J.*, 1942, 95, 402—420).—The equiv. width of the H γ absorption line of the B-type component of HD 193576, during and outside eclipse, the light curve, and spectrographic orbit have been used to determine the abs. dimensions of the system. The Wolf-Rayet star is the larger and brighter, but has the smaller mass. The emission bands of this component are probably not formed in the expanding envelope, but a satisfactory alternative theory is not found. E. R. R.

Luminosities of the M-type variables of small range. P. C. Keenan (*Astrophys. J.*, 1942, 95, 461—467).—E. R. R.

Spectral stages of novæ. D. B. McLaughlin (*Astrophys. J.*, 1942, 95, 428—436).—Spectra of 7 bright novæ are examined in detail. E. R. R.

A table of chronology of a typical nova spectrum is compiled, and the differences of individual objects from averages are discussed. E. R. R.

Material ejected from novæ. (Miss) C. Payne-Gaposchkin and S. Gaposchkin (*Proc. Nat. Acad. Sci.*, 1942, 28, 482—490).—The day-to-day intensities of the bright lines of the novæ Persei 1901, Aquilæ 1918, Cygni 1920, Pictoris 1925, and Herculis 1934 are summarised. Excitation temp. are very high, of the order of those in the nuclei of planetary nebulae. Electron temp. are <10,000°. Fluctuations are due to variations in excitation temp. Electron densities decrease from 10^8 — 10^9 per c.c. at outburst to 10^5 — 10^6 per c.c. The masses of ejected material (10^{27} — 10^{30} g.) are approx. \propto max. luminosities of novæ. W. R. A.

Summary of X-ray satellites. F. R. Hirsh, jun. (*Rev. Mod. Physics*, 1942, 14, 45—54).—A review bringing up to date the available theories and relevant facts, with a guide and bibliography to recent data and literature. N. M. B.

Determination of valency from X-ray absorption spectra. E. Weinstein (*Acta Physicochim. U.R.S.S.*, 1942, 16, 321—330).—The modification of the electron configuration of an atom entering a chemical compound can be determined from an examination of the X-ray absorption curve, as the frequency of the Fermi limit and the selective max. are altered. The electrovalent link is discussed. The rule that the solubility of one metal in another, if a face-centred cubic lattice is formed, is limited by the fact that the electron concn. of the alloy cannot be >1.36 does not hold for certain cases, which are discussed. A. J. M.

Velocity distribution of field electrons. G. Richter (*Z. Physik*, 1942, 119, 406—414).—The theory of field emission is used to obtain the distribution of velocity of field electrons normal and tangential to the emitting surface. The half-val. width in the former case is ~3 times as great as in the latter. This does not agree with the results of Müller (A., 1937, I, 56) or of Henderson *et al.* (A., 1939, I, 229) on W. An explanation is offered. A. J. M.

Electron retardation and recombination radiation in discharges in gases. W. Finkelnburg and O. T. Hahn (*Naturwiss.*, 1942, 30, 468—469).—Conditions for the testing of a theory governing the continuous spectrum in the discharge through gases, formerly proposed (A., 1934, 577, 711), are put forward. The spark spectra of He, H₂, N₂, O₂, and CO₂ have been investigated under different conditions, the results confirming the theory based on the radiation emitted by electron retardation and recombination. A. J. M.

Theory of cathodic sputtering. R. Seeliger (*Z. Physik*, 1942, 119, 482—492).—Difficulties in theory introduced by recent experimental investigations are considered. A. J. M.

Nature of the gas mixture in self-quenching Geiger-Müller tubes. P. Weisz (*Physical Rev.*, 1942, [ii], 62, 477—478).—An investigation of the effect of different quantities of the "quenching gas" on the discharge mechanism is briefly summarised. Results are correlated with the general picture of the discharge mechanism. N. M. B.

Conditions favouring the start of an arc discharge between cold activated electrodes at 50 cycles per second. M. Pirani (*Proc. Physical Soc.*, 1943, 55, 24—34).—The start of the a.c. arc-discharge between two activated electrodes in a rare gas takes place in two stages: a slow discharge with high voltage and low current, and a change-over to the arc-discharge proper with low voltage and high current. The change-over is favoured by electrodes comprising a special pellet producing small amounts of "active Ba." In long tubes, the start of the glow discharge is hampered by wall charges which can be removed by auxiliary devices outside the tube wall. A design dispensing with such devices is described, the wall discharges being removed by glow discharge between auxiliary electrode wires running down the tube. N. M. B.

Conductivity of gases excited by high-frequency discharges. P. Mesnage (*Compt. rend.*, 1942, 214, 702—704).—The method is described and results are given for H₂ and Ne. The conductivity increases rapidly with increasing intensity of exciting field. The resistances of the discharge tubes are not ohmic. A. J. M.

Suggested revision of the position of thorium in the fourth period of the periodic table. G. E. Villar (*J. Chem. Educ.*, 1942, 19, 329—330).—

—The physical and chemical properties of Th justify its transfer to the position occupied by Ac. L. S. T.

Actinium and its products in mineral waters.—See A., 1943, I, 104.

Artificial radioactivity of ^{49}Cr . J. J. O'Connor, M. L. Pool, and J. D. Kurbatov (*Physical Rev.*, 1942, [ii], 62, 413—416).—A newly-observed activity of half-life 41.9 ± 0.3 min. is produced by α -particle bombardment of Ti and by fast-neutron bombardment of Cr; it is assigned to ^{49}Cr . Absorption measurements indicate γ -rays of energies 0.19 and 1.55 Me.v. The end-point of the positron spectrum is 1.45 Me.v. The 33-min. activity in V (cf. Walke, A., 1940, I, 141) is due to ^{47}V , not ^{49}V . N. M. B.

19-Minute isotope of molybdenum and the isotope of element 43 produced from it. W. Maurer and W. Ramm (*Z. Physik*, 1942, 119, 334—351).—The 24-min. activity of Mo (cf. Sagane *et al.*, A., 1940, I, 340) is complex, leading to an active isotope of element 43, with half-life 14.0 ± 0.3 min. The parent Mo has half-life 14.6 ± 0.3 min., and is ascribed the mass-no. 101. It has two β -threshold vals. at ~ 2.2 and 1.0 Me.v. and γ -energies 0.9 and 0.3 Me.v. The element 43 has a β -threshold at ~ 1.3 Me.v. and γ -energy ~ 300 kv. L. J. J.

Radiations from radioactive ^{56}Co . C. S. Cook and P. W. McDaniel (*Physical Rev.*, 1942, [ii], 62, 412—413).—The high-energy 72-day Co activity (cf. Livingood, A., 1941, I, 129) was produced by bombarding a Ni wire with deuterons in a cyclotron. Measurements, following ageing for 2 months, gave identical half-lives of 80 ± 5 days for the β - and γ -rays. The β -ray end-point corresponded with a max. energy of 1.2 Me.v.; the max. γ -ray energy was 2.9, and the average energy 1.74 Me.v. β - γ and γ - γ coincidence data are reported. N. M. B.

Origin of chemical elements. G. Gamow (*J. Washington Acad. Sci.*, 1942, 32, 353—355).—The abundance- Z curve for the elements, decreasing exponentially with Z up to $Z = \sim 50$ and then remaining approx. const., may be the result of rapid expansion leading to nuclear fission of superheavy ($Z > 92$) elements into approx. equal fragments in early evolutionary stages of the universe. L. J. J.

Nuclear structure of the elements. L. H. Sensicle (*Chem. and Ind.*, 1943, 55).—A theory of nuclear structure based on tetrahedra joined by faces, and sometimes by edges, is revived. It is shown how nuclei of elements from ^4He onwards can be built up on this model, the special cases of ^4Be , ^{16}O , and ^{19}F being taken as examples. It is maintained that neutrons do not exist, as such, in the nucleus. A. J. M.

Disintegration curve of mesotrons. B. Rossi and N. Nereson (*Physical Rev.*, 1942, [ii], 62, 417—422).—An experimental determination by investigating the delayed emission of disintegration electrons after the absorption of mesotrons by matter gives an exponential curve corresponding with a mean lifetime of 2.3 ± 0.2 μ -sec. N. M. B.

Scattering of mesons by the matrix method. S. T. Ma (*Physical Rev.*, 1942, [ii], 62, 403—411).—Mathematical. Relations concerning the simpler ζ - and S - (spin) matrices, derived from the β -matrices, are deduced and applied to the calculation of meson scattering by the Coulomb field and by the nuclear interaction. N. M. B.

Stellar rotation. M. Schwarzschild (*Astrophys. J.*, 1942, 95, 441—453).—Equations for the general problem of stellar rotation are deduced and solved in the special case of the standard model in slow rotation. The solution corresponds to solid-body rotation. E. R. R.

Rotation of stars with convective core. G. Randers (*Astrophys. J.*, 1942, 95, 454—460).—Even in extremely slow rotation turbulent convective motion takes place preferentially parallel to the axis of rotation. The consequent polar heating in the main body of the star causes increased rotational velocity towards the equatorial plane. E. R. R.

Statistics of the gravitational field arising from a random distribution of stars. I. Speed of fluctuation. S. Chandrasekhar and J. von Neumann (*Astrophys. J.*, 1942, 95, 489—531). E. R. R.

Dynamics of the interstellar medium. III. Galactic distribution. L. Spitzer, jun. (*Astrophys. J.*, 1942, 95, 329—344).—The effects associated with high galactic masses ($\sim 10^{10}$ M.), especially NGC 3115, are investigated. The analysis consists of the determination of the rate of dissipation of energy by interstellar dust particles and atoms at velocities of ~ 20 km. per sec., the determination of a max. mass of interstellar matter from the examination of a gas in a spherical gravitational field, and the investigation of the equilibrium of dust and atoms in systems possessing angular momentum. Interstellar matter, which may constitute a large fraction of the total mass, is highly conc. to the centre or to the equatorial plane. E. R. R.

Dimensions and constitution of variable stars. (Miss) C. Payne-Gaposchkin and S. Gaposchkin (*Proc. Nat. Acad. Sci.*, 1942, 28, 490—495). W. R. A.

Clustering of nebulae. I. F. Zwicky. **II.** L. Katz and G. F. W. Mulders (*Astrophys. J.*, 1942, 95, 555—564, 565—568). E. R. R.

II.—MOLECULAR STRUCTURE.

Theory of vibration of polyatomic molecules. L. S. Majantz (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 119—121).—Mathematical. L. J. J.

Selection rules for molecular vibration spectra by the classical method. L. S. Majantz (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 122—124).—Mathematical. Selection rules and polarisation properties applicable to Raman spectra are deduced. L. J. J.

Infra-red emission of the electric discharge in molecular gases and its significance for chemical kinetics. A. N. Terenin and H. G. Neuimin (*Acta Physicochim. U.R.S.S.*, 1942, 16, 257—271).—The infra-red emission of the discharge in CO, CO₂, and CH₄, and their mixtures with H₂, N₂, He, A, and O₂, which themselves do not emit in the infra-red, has been investigated in the λ range 1—7 μ , to obtain information about the transfer of vibrational energy in mol. collisions. CO has a band at 7 μ , CO₂ at 4.6 and 2.8 μ , and CH₄ a wide band with a max. at 2.3 μ . The infra-red emission of CO and CO₂ increases with increasing pressure and reaches a max. at 80—100 mm. The infra-red radiation is due to impacts with slow electrons which give up part of their kinetic energy to the mol. vibrations. The relation between intensity of radiation and pressure is obtained. The effect of the added gases on the emission of CO and CO₂ was investigated. He and H₂ cause quenching, N₂ causes increase in emission, and A and O₂ have no effect. CH₄ and CO₂ decompose in the discharge with powerful infra-red emission. A. J. M.

Near infra-red spectrum of water vapour. II. Parallel bands ν_3 , $\nu_1 + \nu_3$, $\nu_2 + \nu_3$ and the perpendicular band ν_1 . H. H. Nielsen (*Physical Rev.*, 1942, [ii], 62, 422—433; cf. A., 1941, I, 29).—Full data and rotational analyses are tabulated and effective vals. of A , B , and C are calc. Revised vals. of ω are $\omega_1 = 3829.4$, $\omega_2 = 1654.5$, and $\omega_3 = 3940.1$. N. M. B.

Infra-red and Raman spectra of polyatomic molecules. XVII. Trideuteromethyl deuterolcohol and trideuteromethyl alcohol. H. D. Noether (*J. Chem. Physics*, 1942, 10, 693—699).—Data are recorded for infra-red frequencies of CD₃·OD and CD₃·OH in the range 2.5—18 μ , and for Raman frequencies of CD₃·OD. Redeterminations of infra-red frequencies of MeOH and MeOD are recorded. Frequencies are assigned in all four cases to C—D and C—H stretching, Me group bending, Me rocking, C—O stretching, and OH. L. J. J.

Effect of thermal expansion on the absorption spectrum of insulators. F. Mögliche and R. Rompe (*Z. Physik*, 1942, 119, 472—481).—Thermal expansion of the lattice produces a displacement of absorption bands towards longer λ . Theory, based on the Krönig theory of electrons in solids, shows that the effect is \propto coeff. of expansion and abs. temp. A. J. M.

Spectroscopic studies of the simpler porphyrins. IV. Absorption and fluorescence spectra of *ms*-tetra-(3':4'-methylenedioxyphenyl)-porphine of hydrogen chloride number four and of its silver pyridine, zinc, and nickel complex salts. V. M. Albers, H. V. Knorr, and D. L. Fry (*J. Chem. Physics*, 1942, 10, 700—705).—Curves showing mol. absorption coeffs. as a function of λ are given for the visible region. The absorption spectra closely resemble those of *ms*-tetraphenylporphine and its corresponding metal complex salts. Fluorescence in the red is found in all four substances (weak in AgC₈H₈N and Ni salts); data are recorded for relative intensity in the case of the parent substance and the Zn salt. L. J. J.

Theory of colour of organic compounds. M. A. Kovner (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 51—52).—The energy levels and spectrum of hexatriene are determined and the position of the absorption band is calc. by a method due to Sklar (A., 1937, I, 547) to be at 2570 Å., in good agreement with experiment (2600 Å.). There is a displacement of absorption bands towards longer λ as the no. of conjugated linkings in a series of compounds is increased. A. J. M.

Constitution of *o*-carboxylic acids in solution. P. Csokán (*Z. physikal. Chem.*, 1942, 191, A, 164—179).—Ultra-violet absorption spectra of PhOH, PhCHO, and salts and derivatives of *o*- and *m*-OH·C₆H₄·CO₂H in various solvents have been measured down to λ 200 m μ . Extinction curves for *o*-cresol, guaiacol, and veratrole resemble those for PhOH and BzOH closely, and no special change accompanies *o*-substitution as such. The curves for *o*-OH·C₆H₄·CHO and *o*-OH·C₆H₄·CO₂H, however, show marked inflexions attributable to the formation of intramol. H bridges; the corresponding *m*-compounds show none, and the *p*-compounds give a weak inflexion suggesting formation of weak intermol. H bridges. These effects are suppressed when R is substituted for the H of either OH or CO₂H. F. L. U.

Ultra-violet absorption spectra of barbituric acid derivatives.—See A., 1943, II, 105.

Absorption spectra of phthalcyclohydrazides at different pH values. V. V. Zelinski and B. J. Sveschnikov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 34, 252—255).—The absorption spectra of solutions of 3-amino- (I), 3-nitro- (II), 3-methylamino- (III), 3-hydroxy- (IV),

3:6-dl(acetamido)- (V), and 4:5-dichloro- (VI) -phthalhydrazides in 0.1% NaOH have been measured over the λ range 2500–4000 Å. (I), (II), (III), and (V) show two absorption max., at ~ 2900 and 3500 Å., differing only slightly in position and intensity, whereas (IV) and (VI) show only single max. In H_2O , (IV) also shows two max. Absorption curves showing one max. at 2900 Å. and 3625 Å. are obtained with solutions of (I) in 10% HCl and 50% NaOH, respectively. The interpretation of the results is discussed.

J. W. S.

Fluorescence of solids in the compact and dispersed states. A. Kuhn (*Kolloid-Z.*, 1942, 100, 126–135).—For substances that fluoresce with the same colour both in the compact state and in solution, and for those that fluoresce as solids but not in solution, the intensity of fluorescence decreases with increased dispersity (grinding in a machine-driven agate mortar with lactose as diluent). For substances that show different fluorescence colours in the two states and for those that fluoresce in solution but not in the compact state it is possible by continued grinding to change the colour of the fluorescence, or to increase its intensity, to that characteristic of the solution. In this case the solid is considered to be spread in a unimol. layer over the surface of the lactose. Experiments with acridine-orange, which stains living protoplasm green and dead protoplasm red, suggest that this behaviour is related to the particle size, since progressive grinding changes the fluorescence colour of the dye from orange-red to greenish-yellow.

F. L. U.

Mechanism of glowing of crystalline phosphors. M. Schön (*Z. Physik*, 1942, 119, 463–471).—The probability of $S \rightarrow G$ transitions is discussed, and estimated, and an explanation of the lower limit of concn. of activators is advanced. The new emission spectrum which should be observed at low temp. and small activator concn. is probably identical with that obtained by Kröger for sulphides (A., 1940, I, 96). The $S \rightarrow G$ transition in phosphors with a no. of different activators is discussed. It is considered that the reverse transition plays an important part in these phosphors.

A. J. M.

Exaggerated phosphorescence of zinc silicate phosphors. H. C. Froelich and G. R. Fonda (*J. Physical Chem.*, 1942, 46, 878–885).—Quenching Zn_2SiO_4 from 1100° has the effect of giving prominence to the second stage of decay of phosphorescence. Phosphors containing 0.5–1.0 mol. of excess SiO_2 do not show this effect. A similar effect is observed if As_2O_5 is added to phosphors activated with Mn. The intensity levels of the second stage of decay rise with increasing $[As_2O_5]$ to a max. at $\sim 0.05\%$ of As_2O_5 and thereafter decrease. Of other elements investigated only Sb behaved similarly to As. The action of As is the same as that of other agents (e.g., inert materials) and consists in the formation of additional lattice defects which increase the no. of available trapping states.

C. R. H.

Dielectric relaxation as a chemical rate process. W. Kauzmann (*Rev. Mod. Physics*, 1942, 14, 12–44).—A comprehensive survey covering the derivation of the differential equation for the relaxation of dielectric polarisation and its solution for static and oscillating fields, physical nature of energy losses in dielectrics, Debye's mol. model for dielectric losses, and factors determining transition probabilities. A comparison of theory with experiment examines the existence and probable origin of distributions of relaxation rates; observed data are summarised and interpreted in terms of mol. processes.

N. M. B.

Dielectric constants of polar liquids and dipole moments. J. K. Sirkin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 43–46).—The formula $\frac{1}{3}\pi N\mu^2/3kT = \{M(\epsilon - 1)/\rho(\epsilon + 2) - [R]\}/\{1 - (\epsilon - 1)^2/(\epsilon + 2)^2\}$ gives good agreement with observation except for strongly associated liquids with H bonding, such as H_2O and EtOH.

F. J. G.

Ionic constant of matter in solid state. M. M. Jakschin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 132–134).—The ratio (ζ) of total to electronic mol. polarisation has been calc. for a no. of cryst. salts and covalent compounds. ζ is ~ 3 for fluorides, ~ 2 for chlorides, 1.8 for bromides, and 1.6 for iodides of alkali and alkaline-earth metals, and characteristically smaller for covalent compounds. For halides, the negative deviation of ζ from the above vals. is an index of their departure from electrovalent character.

L. J. J.

Optical activity of ammonium compounds of quadrivalent platinum. I. I. Tscherniaiev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 336–339).—The compounds RX ($R = [enNH_3NO_2ClNO_2Pt]$, $X = Cl, NO_3$) have been separated into optical antipodes. The rotatory power and dispersion of the following are given: $d-R(d-C_4H_8O_6)$; d - and l - RCl ; d - and l - RNO_3 ; d - and l - $[enNH_2NO_2ClNO_2Pt]$. The coeffs. of amido-inversion for the reactions d - or l - $RX \rightleftharpoons l$ - or d - $[enNH_2NO_2ClNO_2Pt]$ have an average val. of ~ 1.2 .

W. R. A.

Optical polarisation experiments with beeswax. W. J. Schmidt (*Kolloid-Z.*, 1942, 100, 140–151).—Survey and bibliography.

F. L. U.

Quantisation of molecules. K. Fajans (*J. Chem. Physics*, 1942, 10, 759–760).—Comparison with isoelectronic mols. supports the quantum formula $KK; 1^2 2^8$ for N_2 .

L. J. J.

Difficulties in valency bond theory. K. Fajans (*J. Chem. Physics*, 1942, 10, 760–761).—Dissociation energies and ionic properties favour the formula proposed (cf. preceding abstract) for N_2 in comparison with conventional electronic valency formulæ for N_2 and mols. of neighbouring elements.

L. J. J.

Stabilisation and binding of quantised radicals. K. Fajans (*J. Chem. Physics*, 1942, 10, 761; cf. preceding abstract).—An electron-pair may assume a larger or smaller size without change in principal quantum no., according to the positive field strength, or may differ in quantisation. The diamagnetic isoelectronic compounds $Ni(CO)_4$, $Co(CO)_3(NO)$, $Fe(CO)_2(NO)_2$, and the B hydrides can be explained by stabilisation in binding involving particles with 10 and 18 electrons.

L. J. J.

Valency angle of the carbon atom. P. F. Weatherill (*J. Chem. Educ.*, 1942, 19, 35; cf. A., 1942, I, 196).—The angle is easily calc. by spherical trigonometry.

L. S. T.

Calculation of the valency angle [of the carbon atom]. W. H. Dore (*J. Chem. Educ.*, 1942, 19, 29–30).—An alternative method (A., 1942, I, 196) is given.

L. S. T.

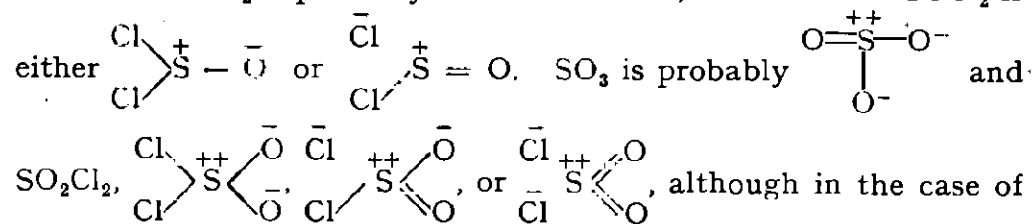
Velocity of sound as a bond property. R. T. Lagermann and J. E. Corry (*J. Chem. Physics*, 1942, 10, 759; cf. Rao, A., 1942, I, 14).—The const. $V = v_s^2 M/d$, where v_s = velocity of sound, can be treated for any liquid as an additive property of increments characteristic of linkings, e.g., for paraffins $V = (n-1)V_{C-O} + (2n+2)V_{C-H}$. Linking increment vals. for C–H, C–C, C–O, O–H, C–Cl, C=C, and C=O are 95.2, 4.25, 34.5, 99.0, 230, 129, and 186, respectively.

L. J. J.

Constitution of hypophosphoric acid and its salts. J. Gupta and A. K. Majumdar (*J. Indian Chem. Soc.*, 1942, 19, 286–287).—Acid K hypophosphate ($KHPO_3$ or $K_2H_2P_2O_6$) and the free acid, in aq. solution, have similar Raman spectra with 6 lines at $< 2000\text{ cm}^{-1}$, suggesting the dimeric *trans*-structure.

F. J. G.

Valency states of sulphur. E. Gurjanova (*Acta Physicochim. U.R.S.S.*, 1942, 16, 181–194).—The valency states of S in its compounds are investigated from a quantum-mechanical viewpoint. The energies of the main valency states of S are calc. from spectroscopic data. The energy of the S–O bond is calc., and from the val. it is deduced that the structure of SO_2 is probably $O^+ \cdot S \cdot O^-$ and $O^- \cdot S^+ \cdot O$, whilst that of $SOCl_2$ is



SO_3 and SO_2Cl_2 there is a considerable difference between the experimental val. of the energy of formation and the energies of the structures. Quantum-mechanical calculations based on Pauling's principle of max. overlapping show that it is unlikely that 4s and 3d electrons take part in the formation of S compounds.

A. J. M.

Potential energy curves in general chemistry. H. N. Alyea (*J. Chem. Educ.*, 1942, 19, 337–339).

L. S. T.

III.—CRYSTAL STRUCTURE.

Interpretation of X-ray diffraction diagrams and evidence of mosaic structures.—See B., 1943, I, 124.

Regular surfaces for space lattice interferences and their most important plane sections as single-crystal diagram curves. H. Seemann (*Z. Physik*, 1942, 119, 374–396).—The properties of non-circular conical surfaces of high order, arising in the interpretation of interferences produced by single-crystals with convergent or divergent irradiation, are discussed.

L. J. J.

Stoichiometric calculations on the basis of crystal lattices. A. Silverman (*J. Chem. Educ.*, 1942, 19, 16).—The effect of isomorphous substitution in the crystal lattice, independent of valency, on stoichiometric relationships is discussed.

L. S. T.

Influence of geometrical factors on the stoichiometric formulæ of metallic compounds illustrated by the structure of KNa_3 . F. Laves and H. J. Wallbaum (*Z. anorg. Chem.*, 1942, 250, 110–120).— KNa_3 has the $MgZn_2$ structure (C_{14}) with a 7.48, c 12.27 Å., $c/a = 1.64$. The at. radii are approx. those of the free metals.

F. J. G.

Electronographic determination of the structure of cadmium bromide. Z. Pinsker (*Acta Physicochim. U.R.S.S.*, 1942, 16, 148–168).—The structure of cryst. films of $CdBr_2$ has been investigated by electron diffraction. Four structures are recognised. When $CdBr_2$ is crystallised from H_2O the lattice type is C_8 or C_{22} . When sublimed in air, and often when crystallised from H_2O , a C_{10} structure may be obtained. The electron method gives more complete results than the X-ray method. The results are not in agreement with those of Bijvoet and Nieuwenkamp (A., 1934, 16).

A. J. M.

Crystal structure of boron carbide, B_4C . H. S. Shdanov and N. G. Sevastianov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 432–434).

—X-Ray examination of B_4C powders and single-crystals, obtained in two ways, shows that only one cryst. modification exists; a_0 5.60, c_0 12.1 Å., and probable space-groups are D_{3d}^5 , D_3^5 , and C_{3v}^5 . The crystal structure is illustrated diagrammatically. L. S. T.

Dihalides of titanium and vanadium. W. Klemm and L. Grimm (*Z. anorg. Chem.*, 1942, **249**, 198—208).— VBr_2 , VI_2 , and one modification of TiI_2 (which is dimorphic) have the CdI_2 (C_6) structure, with ρ_4^{25} (calc.) = 5.44, 4.58, and 4.99, respectively. $TiCl_2$, $TiBr_2$, and VCl_2 have ρ_4^{25} = 3.13, 4.31, and 3.09, respectively. F. J. G.

Peroxytitanyl fluorides. Structure of $(NH_4)_3TiO_2F_6$. G. Peyronel (*Gazzetta*, 1941, **71**, 620—626).—X-Ray analysis (powder method) shows that $(NH_4)_3TiO_2F_6$ (Schwarz *et al.*, A., 1929, 39) has a cubic lattice, a_0 9.20 Å., isomorphous with that of $(NH_4)_3ZrF_7$. The detailed structure is discussed. In the complex $[TiO_2F_5]^{3-}$, Ti has heptahedral coordination, the heptahedron having random orientation to the ternary cubic axis. E. W. W.

Lattice constants of red lead. M. Straumanis (*Z. physikal. Chem.*, 1942, **B**, **52**, 127—130).— Pb_3O_4 is body-centred tetragonal, with a 8.875, c 6.51 Å., c/a = 0.733, and 4 mols. in the unit cell. F. J. G.

Structures of explosive antimony and vitreous selenium. H. Hendus (*Z. Physik*, 1942, **119**, 265—268).—Debye X-radiograms of explosive Sb show interferences which are found by Fourier analysis to correspond to interat. distances 2.87, 3.51, 4.18, and 6.26 Å., resembling those of cryst. Sb, but indicating a liquid structure with 4 atoms in the first coordination group and 12 or 14 in the second. In vitreous Se well-defined interat. distances 2.37 and 3.67 Å. occur, with 2 atoms in the first coordination group, as in cryst. Se. L. J. J.

Crystal structures of iron, ferrous oxide, and ferroso-ferric oxide and their interrelations. H. J. Goldschmidt (*Iron and Steel Inst.*, Aug., 1942, *Advance copy*, 18 pp.).—The lattice spacings of α -Fe, FeO, and Fe_3O_4 , which are all cubic, are in the ratio 1:1.5:3. This explains the comparatively easy oxidation of Fe or FeO in a limited supply of O_2 . The change from FeO to Fe_3O_4 is not regarded as a true oxidation as the no. of O atoms per crystal vol. remains const., only Fe being lost. In solid solutions of the wüstite (FeO) type containing excess of O, Fe^{2+} ions are eliminated from lattice positions with partial replacement by Fe^{3+} ions, and with linear decrease in the lattice spacing. The lattice parameter of Fe_3O_4 is a linear continuation of this decrease. Consideration of the at. vols. indicates that the same relations exist between α -Fe and Fe_3O_4 and between γ -Fe and FeO, the $\gamma \rightarrow \alpha$ -Fe change at 906° being coupled with the decomp. of FeO at 570°. X-Ray tests on layers of scale formed on pure Fe are reported and are discussed in relation to the corrosion-resistance of steel. J. W. S.

X-Ray analysis of rubber and long-chain compounds.—See B., 1943, II, 96.

X-Ray study of humic structural constituents of brown coal.—See B., 1943, I, 96.

Theory of the normal and ideal magnetisation curve of a polycrystalline ferromagnetic. E. Kondorski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 323—326).—Mathematical. W. R. A.

Magnetic structure of iron crystals. W. C. Elmore (*Physical Rev.*, 1942, [ii], **62**, 486—493).—Powder patterns on electrolytically polished surfaces of demagnetised strain-free Si-Fe crystals of known orientation are illustrated and discussed. Since a magnetic field of only 10 oersteds applied normal to the specimens is sufficient to produce patterns, the intensity of the stray fields must be of that order. All evidence indicates a layer magnetisation with alternate layers oppositely magnetised, and of thickness 10—50 μ . in different specimens. Superposed on the primary layer magnetisation is a finer secondary structure, probably localised near the crystal surface, and attributable to dendrite-like regions of reversed magnetisation. N. M. B.

Magnetic and optical anisotropy of selected microscopic crystals and the linear magneto-optical anisotropy of their suspensions. W. Heller, (Miss) G. Quimfe, and Y. Ta (*Physical Rev.*, 1942, [ii], **62**, 479—486).—Superposition of magnetic and orthogonal hydrodynamic orientation is used for measuring the relative magnitude of magnetic anisotropy in para- and dia-magnetic, org. and inorg., microscopic anisometric crystals dispersed in liquids. Some magnetically biaxial crystals show a "two-step" orientation. Optical and magnetic anisotropies are compared. Magnetic double refraction and magnetic dichroism, as observed in dispersed ultra-microscopic V_2O_5 crystals and α - FeO_2H crystals, agree with deductions. Ultra-microscopic α - FeO_2H crystals can orient parallel or perpendicular to the lines of force, depending on temp., and on their size, axial ratio, and magnetic anisotropy. Switching orientation is attributed to a competition between morphic and intrinsic magnetic anisotropy, and is detected, from perpendicular at low temp. to parallel above 25°, by colloidal thixotropy and by the optical effect of "morphic conservative" dichroism. N. M. B.

Course of disorder-order transition reaction in films of pure metals. R. Suhrmann and H. Schnackenberg (*Z. Physik*, 1942, **119**, 287—317).—The decrease of electrical resistance with time, due to cryst-

allisation, in thin (10—100 $m\mu$.) films of Ni, Fe, Cu, Ag, Au, Pb, and Bi, deposited by condensation in a vac. on a glass support at 64° K., has been examined at 77.5° K., 182.5° K., and room temp. In all cases a hyperbolic resistance-time relation is found. Activation energy vals. for the crystallisation process, calc. from the temp.-dependence of this relation, agree with limiting vibrational lattice energy vals. calc. from the characteristic temp. L. J. J.

Theory of crystallisation luminescence. C. Racz (*Compt. rend.*, 1942, **214**, 371—374).—When small quantities of NaCl are pptd. the intensity of the luminescence produced passes through two max., the first (F) being of the nature of a fluorescence and appearing after 5—10 sec. whilst the second (P), which occurs 2 min. later, is like a phosphorescence and decays exponentially. It is suggested that a crystal grows by the formation of successive layers and that when a row of ions is completed by the introduction of an ion on a face of the crystal it gives rise to F luminescence, whereas when it is completed on a crystal edge it gives rise to P luminescence. This view is in accord with the energy changes involved, the ν of the radiation, and with the effects of changes in concn. and agitation of the mother-liquor. J. W. S.

Induced colour in diamonds. J. M. Cork (*Physical Rev.*, 1942, [ii], **62**, 494).—The colour change by deuteron bombardment (cf. A., 1942, I, 391) does not extend throughout the crystal, but probably only as deep as the deuteron penetration. N. M. B.

Measurement of atomic radiation fields in crystals. K. H. Hellwege (*Z. Physik*, 1942, **119**, 325—333).—From the polarisation of radiation emitted or absorbed by crystals, the orientation of electric and magnetic dipoles and quadrupoles, assumed fixed with respect to the lattice, can be deduced for certain lattice types. Triclinic or cubic symmetry excludes this possibility, which arises in certain intermediate cases, e.g., monoclinic and rhombic crystals. L. J. J.

Ultra-violet rotatory power of crystalline nickel sulphate at the temperature of liquid oxygen. W. C. Knopf, jun., and W. C. Gilmore, jun. (*J. Opt. Soc. Amer.*, 1942, **32**, 619—621).—Measurements for the visible spectrum (cf. Rudnick, A., 1941, I, 77) are extended to the ultra-violet. Results in the range $\lambda\lambda$ 2536—4358 Å. show changes of rotatory power of -1.4° to -1.3° per mm. The difference due to temp. change is approx. const. throughout the visible and ultra-violet. N. M. B.

Natural rotatory power of nickel sulphate at low temperature. P. Rudnick and L. R. Ingersoll (*J. Opt. Soc. Amer.*, 1942, **32**, 622—626; cf. preceding abstract).—Revised measurements for the visible and infra-red are reported. The effect of low temp. on rotatory power, circular dichroism, and absorption is plotted and discussed. N. M. B.

Elasticity of a crystal as dependent on temperature. M. Kornfeld and P. Schestichin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **36**, 52—56).—The temp. variation of the rigidity modulus and of the phase angle between deformation and stress has been studied for ice, Sn, and stearin crystals. Observations on polycryst. Sn and ice containing traces of impurities indicate that this variation depends on the crystal lattice itself and is independent of the presence of intercryst. layers. J. W. S.

Deformation of single-crystals of metals facilitated by adsorption of surface-active substances. P. Rebinder, V. I. Lichtman, and V. M. Maslennikov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 125—129).—Sn and Zn monocrystals show the same decrease of yield-point stress on immersion in surface-active solutions, e.g., oleic acid in paraffin oil, as polycrystals. The effect is due to penetration of the surface-active substance along micro-cracks, and leads to a decrease in electrical conductivity in active media. L. J. J.

Effect of glide-plane orientation in single-crystals of tin on their adsorption-promoted deformation. V. I. Lichtman and P. Rebinder (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 130—131).—The increase in plasticity of Sn monocrystals (cf. preceding abstract) due to adsorption of oleic acid is max. when the orientation of glide planes to the crystal axis is 45°. L. J. J.

Peculiarities of the process of plastic deformation in gypsum crystals. E. Vainshtein (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 249—251).—X-Ray diffraction patterns obtained with bent gypsum crystals indicate that the at. planes in the distorted crystal are curved. J. W. S.

Micellar structure and deformation processes with fibrous materials. X. Extension of the amorphous region by "affine" distortion of a micellar network. B. Baule and O. Kratky (*Z. physikal. Chem.*, 1942, **B**, **52**, 142—152; cf. A., 1942, I, 231).—Theoretical. If it is assumed that succeeding micelles are linked together in a network manner it follows that during the extension of cellulose hydrate fibres the spaces between the micelles are stretched. The magnitude of this stretching is calc. on the assumptions that there is an equalisation of tension so that all hinges are equally stretched, and that even over the smallest vols. the distortion is strongly "affine." J. W. S.

Internal structure of synthetic fibres.—See B., 1943, II, 78.

Isodimorphism of β -naphthol and naphthalene. A. Kofler (*Ber.*, 1942, **75**, [B], 998—1001).— β -C₁₀H₇·OH is dimorphous but the two forms are unusually similar in cryst. form and have the same m.p. The direction of greatest rate of growth in them lies in different crystallographical directions. Form A, obtained by solidification of the molten material, readily passes on cooling into form B, which is much the more stable at room temp. The transition temp. is identical with the m.p. A shows complete miscibility with C₁₀H₈. B can form mixtures only with ~5% of C₁₀H₈. By reason of the enhanced stability of A at room temp. induced by the presence of C₁₀H₈, mixed crystals with up to ~90% of β -C₁₀H₇·OH must correspond to the lattice of A. C₁₀H₈ and β -C₁₀H₇·NH₂ do not belong to type III but to type V with almost complete miscibility. H. W.

Molecular arrangement in the anisotropic liquid phase. V. Zvetkov (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 132—147).—The conditions of existence of the anisotropic liquid state and the transformation from this to the amorphous state have been investigated. An anisotropic liquid is regarded as a system of mols. with axial symmetry with an ordering of the mol. axes extending over considerable distances. The magnetic and optical properties of an anisotropic liquid substance are discussed in connexion with the ordering of mols. The transformation from the anisotropic to the amorphous state is accompanied by a sudden change in the degree of ordering and is a transformation of the first kind, involving a change of heat capacity (an expression for which is given), an increase in vol., and absorption of heat. A. J. M.

IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

Extreme properties of matter. (Sir) C. G. Darwin (*J. Inst. Civil Eng.*, 1942—3, 207—222).—A lecture dealing with the limits imposed on the strength of materials, the properties of liquids and gases, ρ , and magnetic permeability by the structure of matter and the forces between elementary particles. A. J. M.

Macromolecular compounds. CCXCIV. Distribution of mol. wt. in degraded celluloses, and a periodic degradation principle in the cellulose molecule. G. V. Schulz and E. Husemann [with H. J. Löhmman] (*Z. physikal. Chem.*, 1942, **B**, **52**, 23—49).—Native cellulose is a uniform material with degree of polymerisation (P) ~3100. The mol. contains five equally-spaced linkages which hydrolyse ~1000 times as rapidly as the other linkages, affording six mols. with P ~510. The chemical nature of these weak linkages is discussed, and certain differences between natural and artificial fibres are interpreted in the light of this finding. F. J. G.

Macromolecular compounds. CCXCV. Distribution of mol. wts. in the degradation of chain molecules having regularly-placed weak points. G. V. Schulz (*Z. physikal. Chem.*, 1942, **B**, **52**, 50—60).—Theoretical. The distribution of mol. wt. in the degradation products of a long-chain mol. in which a few relatively weak linkages occur at equal intervals is investigated mathematically. F. J. G.

Measurement of dielectric loss in solids at very high frequencies. M. Divilkovski (*Compt. rend. Acad. Sci.*, 1941, **32**, 249—251).—Details of a method are given. W. R. A.

Magnetochemical studies. XLI. Magnetic behaviour of the dihalides of titanium and vanadium. W. Klemm and L. Grimm (*Z. anorg. Chem.*, 1942, **249**, 209—218).—Vals. of χ for TiCl₂, TiBr₂, TiI₂, and VI₂ at -183° to 15° are recorded. They do not obey the Curie-Weiss law, and deviate markedly from the vals. for ionic binding. The magnetic behaviour and mol. vol. relationships of the halides of the transitional elements are discussed in terms of the hypothesis of at. binding between the cations. F. J. G.

Magnetochemical studies. XLII. Magnetism of the hydrogen halides. P. Ehrlich (*Z. anorg. Chem.*, 1942, **249**, 219—224).—Vals. of $-X \times 10^6$ at room temp. are as follows: HF, 0.43; HCl, 0.61; HBr, 0.41; HI, 0.374. They are almost independent of temp. F. J. G.

Fresnel reflexion of diffusely incident light. D. B. Judd (*J. Res. Nat. Bur. Stand.*, 1942, **29**, 329—332).—A table showing the reflecting power for diffuse unpolarised light of each side of a plane surface as a function of the relative n of the media bounded by the surface is computed from Fresnel's formula by numerical integration. A range of n from 1.00 to 1.60 in steps of 0.01 is covered. H. J. W.

Dispersion of silicate glasses as a function of composition. II. M. L. Huggins, K. H. Sun, and (Miss) D. O. Davis (*J. Opt. Soc. Amer.*, 1942, **32**, 635—650).—A previously proposed refraction and dispersion equation (cf. A., 1942, I, 84) is improved by the addition, for each component oxide, of a term containing a single new const. (the same for all components), and, for each of the components PbO, CaO, and BaO, of another term containing two additional consts. characteristic of the component. Over the visible range the new equation agrees well with experimental data for simple (cryst. and vitreous) oxides, and for two-, three-, and multi-component glasses. N. M. B.

Heat capacities of molecular lattices. III. Some simple molecular solids. W. F. Brucksch, jun., and W. T. Ziegler (*J. Chem.*

Physics, 1942, **10**, 740—743).—Vals. calc. from Lord's theory (A., 1942, I, 14) for heat capacities of cryst. Cl₂, CO₂, SO₂, COS, N₂O, C₂N₂, C₆H₆, C₂H₄, and MeBr agree well with experimental data. L. J. J.

Surface energy and heat of sublimation of solids. R. Fricke (*Naturwiss.*, 1942, **30**, 544—545).—Theoretical. The potential energy of the surface is obtained from considerations of the third law of thermodynamics and the assumption that the crystal is a set of independently vibrating Planck's oscillators. A. J. M.

Physical properties of alicyclic hydrocarbons. II. B.p. of monocyclic hydrocarbons. G. Egloff and R. C. Kuder (*J. Physical Chem.*, 1942, **46**, 934—945).—From an examination of available data, generalisations on the relation between b.p. and structure of monocyclic hydrocarbons are made. C. R. H.

B.p. nomograph for n -alkyl primary amines. D. S. Davis (*Ind. Eng. Chem.*, 1942, **34**, 1414).—From the data of Ralston *et al.* (A., 1940, I, 388) a nomograph permitting calculation of the v.p. of the compounds n -C _{n} H _{$2n+1$} ·NH₂ ($n = 6$ —18) at 40—35° has been constructed. J. W. S.

Densities of liquefied petroleum gases.—See B., 1943, I, 56.

Differences in the vapour pressures, heats of vaporisation, and triple points of nitrogen (14) and nitrogen (15) and of ammonia and trideuterammonia. I. Kirschenbaum and H. C. Urey (*J. Chem. Physics*, 1942, **10**, 706—717).—From data obtained with natural N₂ and N₂ containing 34.6% of ¹⁵N₂, v.p. (P), heat of vaporisation (ΔH), triple point (T_k) and b.p. (T_b) differences are calc. as $\log P_{14}/P_{15} = 0.7230/T - 0.005822$, $\Delta H_{15} - \Delta H_{14} = 3.33$ g.-cal. per g., $T_{k(15)} - T_{k(14)} = 0.058^\circ$, $T_{b(15)} - T_{b(14)} = 0.052^\circ$. Corresponding data for NH₃ (I) and ND₃ (II) are $\log P_I/P_{II} = 49.69/T - 0.1305$ for the solids, $\log P_I/P_{II} = 46.25/T - 0.14003$ for the liquids; $\Delta H_{II} - \Delta H_I = 227$ g.-cal. per g. for the solids, and 212 g.-cal. per g. for the liquids; $T_{k(I)} = 195.68^\circ$ K. at $P = 4.557$ cm. and $T_{k(II)} = 198.79^\circ$ K. at $P = 4.822$ cm., $T_{b(II)} - T_{b(I)} = 2.37^\circ$. L. J. J.

Differences in the vapour pressures and entropies of the liquid nitrogens. I. Kirschenbaum (*J. Chem. Physics*, 1942, **10**, 717—722).—Quantum-mechanical factors affecting the thermodynamic differences between liquid ¹⁴N₂ and ¹⁵N₂ are greater than would be expected from a harmonic oscillator model. L. J. J.

Evaporation from water drops and wet spherical surfaces. C. S. Karve (*Proc. Indian Acad. Sci.*, 1942, **A**, **16**, 103—114).—The evaporation from wet spheres of porous chalk in the range of Reynolds nos. 600—10,000 has been investigated. W. R. A.

Kinetics of the evaporation of ammonium chloride. H. Spingler (*Z. physikal. Chem.*, 1942, **B**, **52**, 90—116).—The velocity of evaporation of NH₄Cl in a vac. is \ll that calc. from the v.p. An intermediate stage in the process of evaporation is the formation of "free" NH₃ and HCl mols. which wander on the surface. In equilibrium with the vapour these are present at high concn., and their evaporation is the rate-determining step, but in a vac. they are at low concn., and the removal of NH₄Cl ion-pairs from the lattice to the surface, where they dissociate, becomes the rate-determining step. F. J. G.

Statistical theory of liquids. I. G. Jaffé (*Physical Rev.*, 1942, [ii], **62**, 463—476).—The theory developed deduces the elastic and thermal properties of a liquid from the expression of the mutual potential between two mols., considered as centres of force. The two-phase liquid-vapour system is treated as a statistical unit, and thus dynamical expressions for the v.p. and surface tension are obtained. The characteristic parameter of the theory is the mean distance between nearest neighbours. N. M. B.

Stretching and elasticity of rubber.—See B., 1943, II, 96.

Viscosities of carbon monoxide, helium, neon, and argon between 80° and 300° K. Coefficients of viscosity. II. L. Johnston and E. R. Grilly (*J. Physical Chem.*, 1942, **46**, 948—963).—The η , relative to air at 296.1° K., of CO, He, Ne, and Ar have been measured over the range 80—300° K. The data are applied to five well-known η -temp. equations, the three-const. equation of Lennard-Jones giving the best agreement. C. R. H.

Setting temperature of high-molecular glasses and their chemical structure. E. Jenckel (*Kolloid-Z.*, 1942, **100**, 163—170).—Approx. vals. of θ_s , the setting temp. (i.e., temp. region above which the coeff. of thermal expansion is large and below which it is small), are tabulated for a no. of high polymerides. A close connexion exists between θ_s and the viscosity, and it is to be expected that increased difficulty in the relative movement of mols. should correspond with a higher θ_s . That this is so is shown by the higher θ_s of polymerides in which such movement is hindered by the presence of rings in the side-chains (polystyrene), or by cross-linking through principal valencies (polydivinylbenzene) or through dipole formation (polyacrylic acid), and by the lower θ_s observed when the side-chains are mobile aliphatic chains (polybutadiene) or when the dipole-forming forces are screened (polyacrylic esters). In individual polymerides the effects of substitution on the capacity for internal rotation are

also reflected in the θ_s vals.; e.g., polymethyl acrylate and methacrylate have $\theta_s \sim 0^\circ$ and $\sim 100^\circ$, respectively. F. L. U.

Simplifications in the statistical analysis of physical chemical data. B. Egloff and R. C. Kuder (*J. Physical Chem.*, 1942, **46**, 926—933).—A simple method of calculating the standard errors of empirically determined polynomial equations and their parameters is described. C. R. H.

V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

Additive physical properties in hydrocarbon mixtures. R. M. Deanesly and L. T. Carleton (*J. Physical Chem.*, 1942, **46**, 859—870).—A general equation for the additivity of physical properties has been derived and successfully applied to data for sp. vol., sp. n , and the Watson and Nelson characterisation factor for hydrocarbon mixtures (B., 1933, 995). C. R. H.

Refractometric properties of aqueous solutions of electrolyte mixtures. G. Spacu, I. G. Morgulescu, and E. Popper (*Z. physikal. Chem.*, 1942, **B**, 52, 117—126).—Equations are given whereby n for a mixture of two electrolytes in aq. solution can be calc. if the dependence of n on concn. for each is known. Absence of complex-formation is assumed. For $\text{KNO}_3 + \text{NaNO}_3$ and $\text{KCl} + \text{NaCl}$ the equations agree with observation, but deviations occur with $\text{CdCl}_2 + \text{KCl}$, which indicate the formation of CdCl_4^{2-} and perhaps of CdCl_3^- and CdCl_5^{3-} . F. J. G.

Absorption spectra of halogen solutions at low temperatures. A. Prichotko (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 125—131).—The absorption spectra of solutions of Br in C_6H_{12} and of I in EtOH have been investigated in order to obtain data for solutions in associating and non-associating solvents, respectively. There is a considerable displacement of the absorption bands to shorter λ at liquid H_2 temp. This is probably due to the alteration of the potential energy curves of the halogen mol. by the "cage" formed by solvent mols. A. J. M.

Vapour pressures of nitric acid-chloroform and nitric acid-ethyl ether mixtures. J. Desmaroux, R. Dalmon, and R. Vandoni (*Compt. rend.*, 1942, **214**, 352—354).—The system $\text{CHCl}_3\text{--HNO}_3$ includes a wide region over which the partial pressures of the components vary only slightly with change in composition. This indicates that the solutions are in an intermediate state between true solutions and emulsions. In the system $\text{HNO}_3\text{--Et}_2\text{O}$ the partial pressure of Et_2O decreases rapidly with increasing $[\text{HNO}_3]$ and becomes almost zero for equimol. mixtures. This indicates the existence of a compound $\text{HNO}_3\text{--Et}_2\text{O}$. Mixtures of higher $[\text{HNO}_3]$ cannot be studied owing to rapid decomp. even at the temp. of solid CO_2 . J. W. S.

Solubilities of normal saturated fatty acids. A. W. Ralston and C. W. Hoerr (*J. Org. Chem.*, 1942, **7**, 546—555).—The solubilities of the normal, saturated fatty acids from hexoic to stearic inclusive are tabulated in H_2O , EtOH, COMe_2 , COMeEt , C_6H_6 , and glacial AcOH at a no. of temp. H. W.

Classification of rheological properties. R. Bartlett (*Nature*, 1943, **151**, 198).—A modified table is proposed. A. A. E.

Thermo-osmosis at ordinary temperatures and its analogy with the thermochemical effect in helium II. B. Derjaguin and G. Sidorenkov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 622—626).—Thermo-osmotic behaviours at ordinary temp. of H_2O , 0.1N-NaCl, MeOH, iso- $\text{C}_5\text{H}_{11}\text{OH}$, AcOH, and CCl_4 have been investigated; they are similar to the flow of He II. A theoretical treatment is developed. W. R. A.

Mol. wt. determinations as a means of physico-chemical analysis. V. V. Udovenko (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 336—347).—The variation of mol. wt. with composition is determined by the cryoscopic method and plotted in the case of MeOH-EtOH, and PhMe-PhEt mixtures in C_6H_6 , to represent mixtures of similar mols. where there is no chemical interaction, and for piperidine-PhNCS and NHMePh-PhNCS mixtures, where there is interaction. The mol. wt.-composition curve is a straight line where there is no interaction, but the curve shows a max. coinciding with the composition of the compound where there is interaction. A. J. M.

Application of Hammick and Andrew's formula for determining the parachor of a solute. W. V. Bhagwat and P. M. Toshniwal (*J. Indian Chem. Soc.*, 1942, **19**, 225—230).—Theoretical. The work of Lakhani and Daroga (A., 1938, I, 299) is criticised. It is shown that the equation of Hammick and Andrews, $P_M = (1 - x)P_P + xP_z$ (A., 1929, 638), is valid whether the total no. of mols. in the solution is equal to the sum of no. of solute and solvent mols., or changes in consequence of solvation, association, etc. F. J. G.

Glass systems. Refractometric measurements of polar crystals in B_2O_3 glass. S. K. Majumdar and A. K. Sarma (*J. Indian Chem. Soc.*, 1942, **19**, 241—252).—Data on ρ and n_D for solid solutions of alkali chlorides in B_2O_3 glass are recorded, and the vals. are discussed in the light of Fajans' deformation theory. F. J. G.

Viscosity of aluminium-silicon alloys. E. V. Poljak and S. V. Sergeev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **33**, 244—247).— η of molten Al-Si alloys containing <19% Si has been investigated. The η of these alloys is increased by addition of Na. A. J. M.

Ternary systems of aluminium. III. Systems Al-Ni-Si, Al-Mg-Cr, Al-Cu-Ni. H. Hanemann and A. Schrader (*Aluminium*, 1940, **22**, 378—380).—The equilibria at the Al corner of these three systems are shown in ternary diagrams. Al, Al_3Ni , and Si form a ternary eutectic at 568° , Ni 5.20, Si 11.35%. Cr-Al alloys with >2% Mg contain, in addition to Al_2Cr , a ternary phase (T) with Cr 17, Mg 9%. T forms, with Al_3Mg_2 and Al containing 13% Mg in solid solution, a ternary eutectic at 447.4° , Mg 31.1, Cr 1.7%. The two peritectic reactions in the Al-Cr system form valleys in the ternary system terminating at the non-variant points: Mg 12.8, Cr 1.7% (632.7°), and Mg 12.6, Cr 2.3%. At the Al corner of the Cu-Ni-Al system there are 5 ternary phases, three non-variant peritectic temp. (598.8° , Ni 5, Cu 16%; 562.6° , Ni 2, Cu 28%; 551.2° , Ni 1.5, Cu 31%), and a ternary eutectic (546.6° , Ni 0.9, Cu 32.5%). A. R. P.

Mechanism of phase change in some iron-silicon alloys. H. Lipson and A. R. Weill (*Trans. Faraday Soc.*, 1943, **39**, 13—18).—The behaviour of the η phase in alloys with 25% Si has been studied by powder diagrams. In specimens consisting mainly of α -solid solution with a little ϵ and η , examined at intervals during annealing at 720° , the first change consists in the complete disappearance of the α phase and the formation of more ϵ and η , after which η decomposes slowly into $\alpha + \epsilon$. The decomp. is completed in 2 weeks, and the α phase then has a composition differing from the original. It is inferred that the η phase dissociates into $\alpha + \epsilon$ by both a peritectoid reaction at 1030° and a eutectoid reaction at 825° . An explanation on the basis of free energy differences is offered. The hexagonal unit cell of the η phase has a 6.734, c 4.704 Å, d 6.4, with 16 atoms. This indicates a composition Fe_5Si_3 rather than Fe_3Si_2 . Probable space-group $\text{C}6_3$. F. L. U.

Law of changes of crystalline lattice parameter of solid solutions. N. V. Grum-Grshimailo (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **33**, 237—240).—Empirical rules for the variation of lattice parameter with composition of alloys are given, taking into account chemical forces participating in the building up of the crystal lattice as well as the at. vol. of the constituents. The formula proposed is satisfactory for solid solutions if the nature of the components present is correctly known. The formula is applied to Fe-Si, Fe-Al, and Fe-Pd alloys. A. J. M.

Solubility of liquids in compressed gases. Solubility of benzene in compressed nitrogen. I. Kritschewski and D. Gamburg (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 362—375).—The solubility of C_6H_6 in compressed N_2 has been studied at temp. from 35° to 100° , and pressures up to 1100 kg. per sq. cm. The solubility curve shows a min. and a point of inflexion. With increase of pressure the solution acquires a structure. A. J. M.

The hydrogen bond and hydration of organic molecules. L. A. K. Staveley, J. H. E. Jeffes, and J. A. E. Moy (*Trans. Faraday Soc.*, 1943, **39**, 5—13).—The alteration in the solubility of H_2O in dry C_6H_6 caused by the presence of small concns. of PhNO₂, NH_2Ph , NPhMe₂, CHCl_3 , PhBr, and PhOMe has been measured. CHCl_3 and PhBr up to mol. fractions 0.15 and 0.175 have no observable effect; the others increase the solubility of H_2O in the order NPhMe₂ < PhOMe < PhNO₂ < NH_2Ph . The effect is attributed to the formation of a H bond, the H being derived from the org. substance. PhOH produces a greater increase in the solubility of H_2O in C_6H_6 than does MeOH, EtOH, or AcOH. This is probably due to a parallelism between the acidity of a H atom and its readiness to form a H bond; the fact that AcOH is less effective than PhOH despite its greater acidity may be attributed to the fact that in C_6H_6 it is predominantly in the form of double mols. F. L. U.

Solubility of kaolin in water. Z. G. Piñsker, L. I. Tatarinova, and V. A. Novikova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **33**, 231—232).—Electron diffraction experiments indicate that kaolin is slightly sol. in H_2O , forming a true solution. A. J. M.

Dissolution of soaps in mixed solvents. S. R. Palit (*J. Indian Chem. Soc.*, 1942, **19**, 271—285).—Solubility data for Na stearate in binary mixtures of org. solvents are recorded. The term "mix-solvency" is proposed for the phenomenon that a substance is more sol. in a binary mixture than in either constituent. Mix-solvency for soaps occurs in A-G, G-H, and A-G-H mixtures, but not in A-H mixtures, where A, G, and H represent alcohols, glycols, and hydrocarbons or chlorinated hydrocarbons. F. J. G.

Solubility of silicon in aluminium. W. D. Treadwell and R. Walti (*Helv. Chim. Acta*, 1942, **25**, 1154—1162).—The solubility of Si in Al has been determined at $300\text{--}570^\circ$ and from the results the heat of dissolution of Si is calc. as 8.67 kg.-cal. per g.-atom. J. W. S.

Solubility of iron oxide in liquid iron.—See B., 1943, I, 120.

Compounds of aromatic amines with the lower fatty acids. E. Angelescu and R. Giusca (*Z. physikal. Chem.*, 1942, **A**, 191, 145—

163; cf. A., 1936, 1331; 1940, I, 218).—The solubility of o - $C_6H_4Me \cdot NH_2$ in H_2O rises steeply with increasing concn. of $AcOH$, less steeply with $EtCO_2H$, and only slightly with $PrCO_2H$. This affords support for the view that in the homologous series the C_3 member marks a transition from ordinary salt formation to the formation of distinctly homopolar compounds. The effect of adding to these systems the Na or K salt of the acid used shows a reversal on passing through the C_3 member. With $AcOH$ the solubility is greatly depressed, whilst with $PrCO_2H$ it is greatly elevated; with $EtCO_2H$ little change occurs. Further confirmation of the change in the character of the compounds is afforded by the effect on the demixing temp. of solutions of o - $C_6H_4Me \cdot NH_2$ in cyclohexane on the addition of the three acids; the temp. is raised by $AcOH$, lowered by $EtCO_2H$, and lowered more steeply by $PrCO_2H$. F. L. U.

Solubilities and compositions of the phospho-12-tungstates of di-amino-acids and of proline, glycine, and tryptophan.—See A., 1943, II, 82.

Occlusion of inert gases by metals. R. Seeliger (*Naturwiss.*, 1942, 30, 461—468).—The velocity of "clean-up" of inert gases in discharge tubes \propto the current, depends strongly on the cathode metal, and decreases with increasing pressure and with increasing time of exposure. With hollow cathodes the inner surface is roughened, metal having been removed from some places and deposited at others, and it is only at the latter that occlusion occurs. Experiments with spherical cathodes show that there is a balance between two processes, viz., diffusion of gas into the metal, and removal of the outer layers of metal. F. J. G.

Adsorption at solid-liquid interfaces. Determination of adsorption by adhesion-tension and interfacial-tension measurements on binary organic liquid systems. F. E. Bartell and F. C. Benner (*J. Physical Chem.*, 1942, 46, 847—859).—Adhesion tension (against SiO_2) and interfacial tension (against H_2O) measurements on iso - C_8H_{18} - iso - $C_6H_{11}OH$ and iso - C_8H_{18} -cyclohexanol mixtures at 25° are recorded. For a given alcohol, adsorption at the SiO_2 - iso - C_8H_{18} interface is approx. that at the H_2O - iso - C_8H_{18} interface. Calculations by three methods show that the adsorption layer of the alcohol is unimol., and that the alcohol mols. are oriented at both interfaces in much the same way as longer-chain alcohols are on H_2O . C. R. H.

Exchange adsorption of neutral salts by proteins. A. Passinski, Z. Zolotareva, and A. Muchina (*Acta Physicochim. U.R.S.S.*, 1942, 16, 236—256).—The adsorption of neutral salts by gelatin (Ag_2SO_4 , $AgNO_3$, $BaCl_2$), ovalbumin (Ag_2SO_4 , $BaCl_2$, NH_4CNS), and casein ($CaCl_2$) has been investigated analytically and potentiometrically with amalgam electrodes. Comparison of the adsorption of the neutral salt by the protein with the change of pH of the medium shows that in a no. of cases there is a partial exchange of metal ions for H^+ . A. J. M.

Electro-capillary phenomena for various liquid metals. S. Karpatschov and A. Stromberg (*Acta Physicochim. U.R.S.S.*, 1942, 16, 331—335).—Electro-capillary curves for Ag, Sb, Bi, Al, Ga, and Te have been determined, the fused eutectic mixtures of KCl and LiCl being used as electrolytes. In a no. of cases, but not for Ag, the max. p.d. in the electro-capillary curve is the same as the val. obtained in aq. solution. A. J. M.

Disorder-order transition reaction in metal films.—See A., 1943, I, 83.

Contact angles at liquid-liquid-air interfaces. Erratum. W. Fox (*J. Chem. Physics*, 1942, 10, 743; cf. A., 1943, I, 13).

Solidified water-films. H. Löwy (*Phil. Mag.*, 1943, [vii], 34, 67—70).—By applying the theory of dielectric mixtures and available vals. of consts. to the system air, desert soil, and solidified (adsorbed) moisture film, a method for evaluating the mean density, vol., and thickness of film is deduced. N. M. B.

Properties of dialysed hydrous alumina hydrosols. II. Titration with bases and acids. N. P. Datta (*J. Indian Chem. Soc.*, 1942, 19, 191—203).—Titration curves with acids and alkalis are recorded for dialysed Al_2O_3 sols. With alkalis there is strong buffering at pH \sim 11, and analysis of ultrafiltrates indicates that at pH $>$ 11 Al is present in true solution as AlO_2^- . During the first small additions of HCl both H^+ and Cl^- disappear from solution owing to surface reaction with the colloid. The absorbed Cl^- ion may be displaced by addition of H_3PO_4 , $H_2C_2O_4$, or H_2SO_4 , but not of $AcOH$. F. J. G.

Effect of light and ageing on colloidal solutions of ferric hydroxide and thorium hydroxide. R. B. Nairpally, P. M. Barve, and B. N. Desai (*J. Indian Chem. Soc.*, 1942, 19, 204—206).—Cataphoretic mobility, conductivity, and stability of $Fe(OH)_3$ and $Th(OH)_4$ sols decrease on exposure to sunlight or on ageing. F. J. G.

Ionic activity in colloidal solutions. III. Donnan effect in ultra-filtration of colloidal solutions of ferric hydroxide. A. J. Rabinovitch and R. Borodulina (*Acta Physicochim. U.R.S.S.*, 1942, 16, 348—356).—The sum of pCl and pH required by Donnan's equilibrium holds for $Fe(OH)_3$ sols, the ultrafiltrates, and residues. For all the sols studied there were considerable differences in the ionic composition of the sol and ultrafiltrate. A. J. M.

Reversible aggregations of colloidal particles. III. Isothermal reversible sol syneresis. W. Heller (*J. Physical Chem.*, 1942, 46, 783—793).—A thixotropic gel of β - $FeOOH$ changes into a reversibly syneretic system if $[FeOOH]$ is $<$ a limiting val., C_{cr} . The val. of C_{cr} depends on electrolyte concn. and on the diameter (d) of the container. For $[NaCl]$ 30, 38, and 46 millimol. per l. and for $d = 1.2$ cm., $C_{cr} = \sim 10, 8.8$, and 7.2 g. per l., respectively. The degree of syneretic separation into a conc. and dil. phase is a linear function of $[FeOOH]$. The application of the term "syneresis" to the spontaneous separation of a gel into two phases is considered inadequate since it does not take into account the effect of d before separation, the pre-separation systems being gels when d is large and sols when d is small. Separation is regarded as a syneresis if, in a sol or gel of given vol., a more conc., coherent, and elastic phase of smaller vol. separates and if the phase is limited by a sharp boundary. Syneresis is limited not only by an upper concn. limit, C , but by a lower one below which the conc. phase disappears, i.e., absence of geloid formation. Adhesion of geloid structures to the container walls probably accounts, in part, for the varying effects of d . C. R. H.

Elasticity of a network of long-chain molecules. I. L. R. G. Treloar (*Trans. Faraday Soc.*, 1943, 39, 36—41).—The discrepancy between the results obtained by Kuhn (A., 1934, 959; 1936, 1337) and by Wall (A., 1942, I, 204, 326) for the stress-strain relation in the elongation of a three-dimensional network is due to an approximation introduced by the former. Kuhn's treatment when suitably amended leads to a relation identical with Wall's. An extension of Kuhn's method to the calculation of the work required to produce a certain shear deformation is also in agreement with Wall's result. F. L. U.

Equation of state of synthetic rubbers.—See B., 1943, II, 95

Viscosities of polyester solutions. Application of the melt viscosity-mol. wt. relationship to solutions. P. J. Flory (*J. Physical Chem.*, 1942, 46, 870—877).—The η of Et_2 succinate (I) solutions of poly-decamethylene adipate (II) at 79° have been determined. The relation $\log \eta = A + C\bar{Z}_w^{0.5}$, where \bar{Z}_w = average chain length [taking (I) and (II) into consideration] and A and C are consts., is applicable to solutions containing $>10\%$ of (II). In these solutions viscous flow seems to involve successive displacements of comparatively small sections of the chain, whereas in dil. solutions the mols. of (II) move more or less as units. C. R. H.

Physico-chemical characteristics of glycogens.—See A., 1943, II, 57.

Comparative osmotic and viscosimetric mol. wt. determinations on fractionated and unfractionated nitrocelluloses. E. Husemann and G. V. Schulz (*Z. physikal. Chem.*, 1942, B, 52, 1—22).—Measurements of η and of osmotic pressure for degraded nitrocelluloses are recorded. The Staudinger equation $Z_\eta = K_m \cdot P$ is fulfilled over the mol. wt. range 17,000—400,000, and the vals. of K_m afford a measure of the degree of uniformity of the material. F. J. G.

General chemistry of colloid-colloid reactions. IX. Very pure hydrophobic colloids and proteins, their protection mechanism. W. Pauli and P. Dessauer (*Helv. Chim. Acta*, 1942, 25, 1225—1250).—Very pure serum-albumin (I) and ovalbumin (II) show mutual coagulation with very pure Congo-blue, Sb_2S_3 , Au, As_2S_3 , and $FeOOH$ sols. This flocculation occurs through interionic reaction and is conditioned by the electric field of the hydrophobic colloid and the multivalent zwitterion character of the protein, which thereby loses its charge, H_2O of hydration, and stability. The presence of a uni-univalent neutral salt ($NaCl$) prevents the mutual coagulation. The coagulation of (I), unlike that of (II), does not tend to disappear at high protein concn., but concns. of both proteins $<10^{-3}\%$ cause sensitisation towards pptn. by salts. $FeOOH$ sols coagulated with (I) or (II) can be reconverted into a stable sol by subsequent addition of $NaCl$, but with As_2S_3 only slight indications of this reversibility are obtained. It is suggested that at very low protein concn. the aggregates comprise a nucleus of protein surrounded by the hydrophobe, whilst at higher protein concn. the aggregates are built from double particles of hydrophobe and protein. The difference in behaviour between (I) and (II) is discussed. Electrophoretic measurements indicate that the $NaCl$ increases the acid dissociation of the protein, thereby increasing the negative charge on the particle. $La(NO_3)_3$, however, produces a positive charge on the particles owing to adsorption of La^{+++} . J. W. S.

New method for the determination of electrokinetic potential in the flow of a semiconducting liquid through a single capillary. W. G. Eversole and W. W. Boardman (*J. Physical Chem.*, 1942, 46, 914—926).—A method for obtaining data to be used in calculating true electrokinetic potentials (ζ) is presented. Data for KCl solutions in soft glass, Pyrex, and SiO_2 capillaries and for KOAc solutions in Pt capillaries are tabulated. For a given KCl solution ζ decreases in the order Pyrex $>$ SiO_2 $>$ soft glass. The abnormal course of ζ versus $[KCl]$, where ζ is obtained by means of the usual form of the Helmholtz-Smoluchowski equation, is attributed to surface conductance of the capillary walls. C. R. H.

VI.—KINETIC THEORY. THERMODYNAMICS.

Solvation of the ions Li⁺, Na⁺, K⁺, Cl⁻, I⁻ in methyl alcohol and in acetophenone. (Mlle.) M. Cordier (*Compt. rend.*, 1942, 214, 707—708).—From ionic mobilities and apparent mol. vol. in solution, with the assumption that I⁻ ion is unsolvated, the following solvation nos. are computed; in MeOH: Li⁺, 4; Na⁺, 2.2; K⁺, 1.2; Cl⁻, 1; and in CPhMe: Li⁺, 1; Na⁺ and K⁺, ~0.5. F. J. G.

Indium. VI. Effects of certain hydroxy anions on the precipitation of hydrous indium hydroxide. T. Moeller (*J. Physical Chem.*, 1942, 46, 794—800).—pH changes during the titration with NaOH of 0.05M-In₂(SO₄)₃ in presence of equimol. quantities of alkali citrates, tartrates, and malates have been investigated. At these and higher concns. of org. salt, hydroxide pptn. is inhibited. Hydronium ion is released to the extent of 1.25, 1.50, and 1.50 mols. per mol. of In⁺⁺⁺ for these salt solutions respectively. Reference is made to the possibility of volumetrically determining In by titrating the liberated hydronium ion. Alkali lactate does not inhibit hydroxide pptn. C. R. H.

Ionic concentration gradients and their biochemical significance. III. F. Almasy (*Helv. Chim. Acta*, 1942, 25, 1255—1284; cf. A., 1942, I, 366).—The problem of non-stationary diffusion fields is discussed theoretically. The results are discussed in relation to biological problems, in particular to ionic exchange between blood and urine through the kidney, and to protein synthesis. J. W. S.

Activity of the chloride ion in concentrated solutions of hydrochloric acid containing alkaline-earth chlorides. M. Duboux and C. Vuilleumier (*Helv. Chim. Acta*, 1942, 25, 1319—1328).—The e.m.f. of cells of the type Pt, H₂|HCl with or without MCl₂|Hg₂Cl₂|Hg and Pt, H₂|HCl with or without MCl₂|KCl (saturated)|Hg₂Cl₂|Hg (M = Ca, Sr, or Ba) have been measured at 25° and at total chloride concns. 0.825M. and 4.1M. On the assumption that the difference between the liquid junction potentials HCl(m) + MCl₂(m₁)|KCl (saturated) and HCl(m)|KCl (saturated) is independent of the nature of M it is shown that the free energy of transfer of Cl⁻ from HCl(m) to the solution HCl(m) + MCl₂(m₁) is also independent of the nature of M and hence in these solutions the activity of the Cl⁻ is independent of the cation. J. W. S.

Hydrogen ion activity and the hydrolysis of sucrose and methyl acetate in concentrated hydrochloric acid containing alkaline-earth chlorides. M. Duboux and C. Vuilleumier (*Helv. Chim. Acta*, 1942, 25, 1329—1344; cf. preceding abstract).—In solutions containing HCl (concn. m) and MCl₂ (concn. m₁) (M = Ca, Sr, or Ba) the mean activity coeff. of HCl (γ_{HCl}) is shown to increase only slightly with increasing [HCl] for solutions where m + m₁ = 0.825M., but to show a greater increase with increasing [HCl] for solutions where m + m₁ = 4.1M. In each series of dil. solutions γ_H decreases with increasing [HCl] but in the conc. solutions it passes through a min. at m = 2M. In each series of mixtures the velocity coeff. (k) of the hydrolysis of sucrose or MeOAc varies according to log (k/m) = α + βm, where α and β are consts., and is approx. α the H⁺ activity. This relationship, however, is exact only for the hydrolysis of MeOAc in the dil. solutions. The anomalies observed are attributed to variations in the activity of H₂O which affects the two reactions differently. J. W. S.

Ionic activity in colloidal solutions.—See A., 1943, I, 89.

Phenolic behaviour of buchu-camphor, etc.—See A., 1943, II, 97.

Phase equilibria in hydrocarbon systems. Methane-decane system. H. H. Reamer, R. H. Olds, B. H. Sage, and W. N. Lacey (*Ind. Eng. Chem.*, 1942, 34, 1526—1531).—From the sp. vol. of five mixtures of CH₄ and C₁₀H₂₂ established at 7 temp. between 38° and 238° and at pressures up to 10,000 lb. per sq. in. the dew-point pressures and the properties of the coexisting phases have been established. C. R. H.

Binary systems involving ethylene chlorohydrin. Vapour-liquid equilibria. H. B. Snyder and E. C. Gilbert (*Ind. Eng. Chem.*, 1942, 34, 1519—1521).—Vapour-liquid equilibria for binary mixtures of Cl-[CH₂]₂-OH (I) with Pr^βO, Bu^βOH, Bu^αOH, Bu^αO, C₆H₆, PhMe, and (Cl-[CH₂]₂)₂O (II) are recorded. Azeotropes were observed in three cases, viz., with Bu^αO at 123.0° for 68 mol.-% of (I), with PhMe at 106.9° for 27 mol.-% of (I), and with (II) at 128.2° for 91.8 mol.-% of (I). None of the systems gave evidence of the formation of immiscible pairs. C. R. H.

Equilibria in ethanol-water system at pressures less than atmospheric. A. H. Beebe, jun., K. E. Coulter, R. A. Lindsay, and E. M. Baker (*Ind. Eng. Chem.*, 1942, 34, 1501—1504).—The complete equilibrium relations in the system EtOH-H₂O at 95, 190, and 380 mm. Hg abs. pressure have been ascertained. For a liquid composition of 0.21 mol. fraction of EtOH, the equilibrium is independent of pressure within the pressure range examined. There is a lowering of the relative volatility of EtOH with lowered pressures at liquid compositions <0.21, and an increase of relative volatility at compositions >0.21, mol. fraction of EtOH. The significance of the data is discussed with reference to commercial rectification at pressures < atm. C. R. H.

Boric acid and hydroxy-compounds. I. Complex formation of boric acid with salicylic acid in aqueous solution. H. Schäfer (*Z. anorg. Chem.*, 1942, 250, 82—95).—The equilibria OH·C₆H₄·CO₂H + H₃BO₃ ⇌ 2H₂O + C₆H₄ <CO₂>BO' (I) and (I) + OH·C₆H₄·CO₂H ⇌ H₂O + C₆H₄ <CO₂>B <CO₂>C₆H₄' (II) in aq. solution have been studied, and vals. for the equilibrium consts. are recorded as follows: K₁ = [(I)]/[H₃BO₃][OH·C₆H₄·CO₂H] = 23; K₂ = [(II)]/[(I)][OH·C₆H₄·CO₂H] = 134. (I) exists at pH ~3—9, (II) only in a small range at pH ~3. F. J. G.

Systems phenol-glucose β-penta-acetate, phenol-cellobiose α-octa-acetate, and p-nitrophenol-cellobiose α-octa-acetate. R. J. B. Marsden, J. M. Bainbridge, and A. Morris (*Trans. Faraday Soc.*, 1943, 39, 1—5).—F.p.-composition curves show that PhOH and glucose β-penta-acetate form a simple eutectic at -4.8° and 81.8 mol.-% PhOH with no indication of compound formation. PhOH and cellobiose α-octa-acetate (I) also form a simple eutectic at ~17° and 92 mol.-% PhOH, and a slight indication of compound formation observed near 20 mol.-% PhOH is rendered uncertain by a small amount of decomp. The p-OH·C₆H₄·NO₂-(I) system exhibits two well-defined compounds with mol. ratios 1:2 and 2:1. The latter can be readily explained by a H-bond structure, and its existence supports the view that the swelling of cellulose acetate in aq. phenols is due in part to the formation of a H-bond complex, especially since p-OH·C₆H₄·NO₂ shows higher swelling activity than PhOH (cf. B., 1942, II, 399). F. L. U.

System ethyl alcohol-glycerol-carbon tetrachloride at 25°. H. J. McDonald, A. F. Kluender, and R. W. Lane (*J. Physical Chem.*, 1942, 46, 946—948).—Data for the system within the immiscibility region are recorded in tabular and triangular diagrammatic form. C. R. H.

Constitution diagram of the reciprocal system of fluorides and carbonates and of chlorides and carbonates of sodium and potassium. N. N. Volkov and A. G. Bergman (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 47—50).—Equilibrium data for the systems NaF-KF-Na₂CO₃-K₂CO₃ and NaCl-KCl-Na₂CO₃-K₂CO₃ are recorded. F. J. G.

Double decomposition in the absence of a solvent. Singular irreversible-reciprocal systems without separation into layers from potassium and calcium chlorides and fluorides and sodium and calcium chlorides and fluorides. I. E. Krauze and A. G. Bergman (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 20—24).—The systems Na, Ca|F, Cl and K, Ca|F, Cl in which double decomp. tends to occur with the formation of CaF₂ and NaCl and CaF₂ and KCl, respectively, have been studied. The compound KF, CaF₂, m.p. 1070°, has been shown to exist. J. W. S.

Thermal data. XV. Heats of combustion and free energies of some compounds containing the peptide bond. H. M. Huffman (*J. Physical Chem.*, 1942, 46, 885—891).—The heats of combustion have been obtained for dl-alanyl- (626.40), glycyl- (471.48), hippuryl- (1246.38), and dl-leucyl-glycine (1093.09 kg.-cal. per mol.). The respective free energies of formation are -116.85, -117.10, -118.07, and -112.13 kg.-cal. per mol. For hippuric acid the val. is -88.63 kg.-cal. per mol. C. R. H.

Empirical equation for thermodynamic properties of light hydrocarbons and their mixtures. II. Mixtures of methane, ethane, propane, and n-butane. M. Benedict, G. B. Webb, and L. C. Rubin (*J. Chem. Physics*, 1942, 10, 747—758; cf. A., 1940, I, 248).—The authors' empirical equation for pure hydrocarbons is generalised for mixtures. The fundamental equation for free energy leads to equations of state and for fugacity, isothermal variation of enthalpy, and isothermal variation of entropy. Parameters are determined from vals. for pure CH₄, C₂H₆, C₃H₈, and n-C₄H₁₀, applicable to mixtures. Agreement with observed volumetric properties and liquid-vapour equilibria is satisfactory. L. J. J.

Proton affinities of NH₃, H₂O, and OH⁻. G. Briegleb (*Naturwiss.*, 1942, 30, 469—470).—By means of cycles the proton affinities of NH₃, H₂O, and OH⁻ are found to be 214, 184, and 392 kg.-cal. respectively and the heat of hydration of H⁺ 277 kg.-cal. F. J. G.

VII.—ELECTROCHEMISTRY.

Potential of the ozone electrode. E. Briner and A. Yalda (*Helv. Chim. Acta*, 1942, 25, 1188—1202).—By assuming that the free energy change of the decomp. of O₃ into O₂ is wholly converted into electrical energy the c.m.f. of the cell O₃ (1 atm.)|solution|O₂ (1 atm.) is calc. to be 0.83 v. at 0° and 0.84 v. at 20°. The fact that the experimental vals. determined under various conditions differ considerably from this val. is attributed to factors of irreversibility, particularly the thermal decomp. of O₃. The effects of the [O₃] (in O₂), temp., dimensions and surface of the Pt electrodes, and concn. of the H₂SO₄ or KOH used as electrolyte on the potential of the O₃ electrode have been investigated. The fact that the observed difference between the potentials of the O₃ and O₂ electrodes is >> the

theoretical val. is attributed to an improvement in the reversibility of the O_2 electrode owing to the presence of O_3 . J. W. S.

Theory of galvanic cells subject to fields of force. II. Electric and magnetic field. F. O. Koenig and S. W. Grinnell (*J. Physical Chem.*, 1942, **46**, 980—1005; cf. A., 1940, I, 258).—A mathematical analysis of the thermodynamics of galvanic cells subject to stationary electric or magnetic fields is presented. C. R. H.

Theory of electrolytic reduction. R. Audubert and (Mlle.) M. Quintin (*Compt. rend.*, 1942, **214**, 704—705).—A more satisfactory theory of electrolytic reduction than that put forward by Haber and Russ takes into account the energy of activation of the ion. An equation for the current strength is deduced. A. J. M.

Retardation phenomena in the electrolytic formation of metallic crystals and their growth. A. Samartzev (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 206—235).—Certain impurities in electrolytes, acting like protective colloids, can hinder the growth of crystals of metals deposited electrolytically on a cryst. cathode. Such substances may be definite additions to the electrolyte, or they may be hydroxides formed at the cathode. Colloids are adsorbed by the electrodes and hinder the formation of new crystal nuclei and the growth of crystals. The separation of Ag from $AgNO_3$ was particularly studied, and the growth of a single crystal of Ag was investigated. The growth of a surface can occur only if the c.d. is < a certain val. Places where the c.d. is > this val. become covered with an adsorbed layer and are rendered passive. A. J. M.

VIII.—REACTIONS.

Velocity of phase transformations. N. Akulov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 340—343).—The temp.-dependence of the velocity of phase transformations is discussed mathematically. W. R. A.

Mathematical theory of thermal explosions. A. A. Frank-Kamenetzki (*Acta Physicochim. U.R.S.S.*, 1942, **16**, 357—361).—Crit. explosion conditions for spherical and infinite cylindrical vessels are worked out. A. J. M.

Explosion limit of $2H_2 + O_2$ mixtures at atmospheric pressure. M. S. Ziskin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **34**, 256—258).—The explosion temp. of $2H_2 + O_2$ mixtures in Mo-glass vessels varies from 531° to 595° as the diameter of the explosion vessel is decreased from 30 mm. to 5.5 mm. The velocity of flow of the gas has little effect on the explosion temp. The results are in accord with the theoretical vals. calc. by Frank-Kamenetzki (A., 1939, I, 614). J. W. S.

Activation characteristics of the thermal cracking of methane. N. I. Kobozev and E. N. Eremin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **33**, 223—226).—The kinetics of the cracking of CH_4 at low pressures, and when mixed with H_2 , have been investigated. Decrease of pressure accelerates the cracking processes: $2CH_4 \rightarrow C_2H_4 + 2H_2$ and $C_2H_4 \rightarrow C_2H_2 + H_2$. Dilution of CH_4 fourfold has approx. the same effect as a nine-fold decrease of pressure. The kinetic consts. obey the Arrhenius equation over a wide temp. range. A. J. M.

Electronic theory of the English school.—See A., 1943, II, 77.

Rates of pyrolysis and bond energies of substituted organic iodides. I. E. T. Butler and M. Polanyi (*Trans. Faraday Soc.*, 1943, **39**, 19—36; cf. A., 1940, II, 321).—The influence of substitution on the C—I bond strength has been studied by measuring the rates of pyrolysis of org. iodides RI ($R = Me, Et, Pr^a, Bu^a, CH_2:CH, CH_2:CH:CH_2, Ac, CH_2Ac, Ph, CH_2Ph, Bz$), present at low partial pressures in a carrier gas (H_2, N_2), the amount of decomp. being kept small to minimise secondary reactions. The results show marked variations, and for a no. of simple hydrocarbons the activation energy (Q) of the reaction $RCI + Na$ is \propto the bond energy $R-I$, with a proportionality factor 0.28 in fair agreement with theory. Negative substituents depress Q below the val. corresponding with the bond energy. F. L. U.

Application of synionic reactions to the quantitative separation of the steric and polarity effects. C. Prévost (*Compt. rend.*, 1942, **214**, 357—359).—It is suggested that the velocity of a reaction is determined by a mobility factor M , associated with the electrostatic effects of the substituents, and a steric hindrance effect S , so that the velocity coeff. can be expressed by $k = CM/S$, where C is a const. characteristic of the type of reaction involved. This view is confirmed by measurement of the relative rates of reaction of $Bu^aCl, CHMe:CH:CH_2Cl, Bu^bCl$, and $CHMeCl:CH:CH_2$ with aq.-EtOH solutions of $AgNO_3$ or $NaOAc$, EtOH solutions of $NaOEt, C_6H_5N$, or NH_3 , and with H_2O in $COMe_2$. J. W. S.

Study of the mechanism of the Beckmann rearrangement by the isotopic method.—See A., 1943, II, 94.

Viscosimetric and volumetric analysis of the addition of oxygen to the triglycerides.—See A., 1943, II, 80.

Kinetics of development of individual grains of a photographic emulsion. A. J. Rabinovitsch, A. N. Bogojavlenski, and J. S. Zuev

(*Acta Physicochim. U.R.S.S.*, 1942, **16**, 307—320).—The kinetics of development of individual grains of $AgBr$ have been determined experimentally, the case of regular development, beginning from one of the edges of the crystal and rapidly spreading over the whole surface as a more or less circular zone, being particularly examined. The radius of the zone of darkening varies exponentially with time. With increasing temp. the rate of darkening is increased and the induction period shortened. A. J. M.

Reaction of gases on the surface of a single crystal of copper. I. Oxygen. A. T. Gwathmey and A. F. Benton (*J. Physical Chem.*, 1942, **46**, 969—980).—The reaction between O_2 and Cu has been examined by photographing the surface of a single Cu crystal, spherically ground and polished. After heating in air definite patterns are formed depending on the crystal plane which is exposed on the spherical surface. The rate of oxidation is greatest on the (100) and (210) planes and least on the (311) plane. C. R. H.

Reduction of water vapour by aluminium in presence of traces of mercury. L. Hackspill and R. Rohmer (*Compt. rend.*, 1942, **214**, 490—493).—Between 20° and 90° the speed of the reaction between Al and H_2O vapour in presence of Hg diminishes with rise of temp., evolution of H_2 ceasing at the latter temp. The $Al_2O_3 \cdot nH_2O$ formed is amorphous with $n > 3$. At 210° evolution of H_2 recommences, Al_2O_3 being formed. The behaviour is more complex than that observed in similar experiments with Mg (cf. *Bull. Soc. chim.*, 1939, [v], 6, 458). C. R. H.

Influence of nitrogen peroxide on the low-temperature ignition of diethyl ether. G. P. Kane and M. G. Pandit (*Proc. Indian Acad. Sci.*, 1942, **A**, 16, 87—94).—The direct oxidation is increased, the min. pressures for ignition are decreased, the cool flame reaction is inhibited, and the induction lag is increased. As $[NO_2]$ is increased the $[MeCHO]$ in the pre-cool flame reaction decreases. MeCHO is considered to be of primary importance in the formation of cool flames. W. R. A.

Organic catalysts. XXIV. Aldol condensation in the presence of secondary amino-acids.—See A., 1943, II, 82.

Reactions of solid substances. CXXIX. Reducibility of iron oxide with hydrogen in presence of small amounts of foreign gases. K. Sedlatschek (*Z. anorg. Chem.*, 1942, **250**, 23—35).—The velocity of reduction of Fe_2O_3 by H_2 at 300 — 600° is not affected by small additions of NH_3, NO , or SO_2 , but is increased by HCl, Cl_2, HBr , or Br_2 . In certain temp. ranges the effect of Cl_2 (or Br_2) is > that of HCl (or HBr), owing to raising of the surface temp. by catalytic combination with H_2 . F. J. G.

Reactions of solid substances. CXXVIII. Influence of foreign gases on the thermal decomposition of calcium sulphate in presence of silica. F. von Bischoff (*Z. anorg. Chem.*, 1942, **250**, 10—22).—The reaction between $CaSO_4$ and SiO_2 at 1050 — 1150° in presence of various gases has been studied. The rates in A and N_2 are nearly equal, and as compared with these O_2 has a slight and SO_2 a marked retarding effect, whereas H_2O greatly accelerates the reaction. The product is $CaSiO_3$ in all cases, and the Arrhenius equation is obeyed. F. J. G.

Activation of catalysts by electric waves. J. A. Hedvall and G. A. Ahlgren (*Kolloid-Z.*, 1942, **100**, 137—140).—Electrolytic Ni in the form of Fe-free filings 0.3—0.6 mm. long, packed in a spiral tube 22 cm. long and of 5 mm. bore, was used as catalyst in the decomp. of N_2O at 304° . When the tube is exposed to waves from a 4-w. radio-transmitter or from a large induction coil the decomp. is increased by 14—38%. This behaviour is related to that of the "coherer" formerly used for detecting electromagnetic waves, the action of the waves being to modify the surface of the metal particles so that they become conducting. The formation in this manner of interparticulate metal "bridges" provides conditions favourable to an incomplete lattice structure corresponding with an increase in the no. of active centres. Tapping the tube (whereby the bridges are broken) leads in every case to decreased catalytic activity. F. L. U.

Influence of the transition from ferromagnetism to paramagnetism on catalytic activity. G. Cohn and J. A. Hedvall (*J. Physical Chem.*, 1942, **46**, 841—847).—The activation energy of the decomp. of HCO_2H at 130 — 180° catalysed by Co-Pd alloy containing 85 at.-% of Pd is increased $\sim 30\%$ on transition of the catalyst from the ferro- to the para-magnetic state. At the same time the temp.-independent const. of the Arrhenius equation increases 1000-fold. The increased activity is due to a state of higher electronic order in the catalyst. C. R. H.

Catalytic activity of intermetallic compounds in the vapour-phase reduction of nitrobenzene. II. B. Berk and O. W. Brown (*J. Physical Chem.*, 1942, **46**, 964—968; cf. A., 1939, I, 424).—Cu-Zn, Cu-Sn, and Cu-Sb compounds have been examined for suitability as catalysts for the vapour-phase reduction of $PhNO_2$ to NH_2Ph . The Cu-Zn catalyst has the same general properties as pure Cu, Cu-Sn has the properties of Cu and Sn, and Cu-Sb has properties quite different from those of Cu and Sb, the temp. of max. activity being > that for Cu or Sb alone. C. R. H.

Rearrangement of phenyl octoate with ferric chloride, titanium tetrachloride, stannic chloride, and zinc chloride.—See A., 1943, II, 93.

Proton transfer during the electrolytic discharge of hydrogen ions. O. Essin and V. Kosheurov (*Acta Physicochim. U.R.S.S.*, 1942, 16, 169—180).—The mechanism of the reaction $\text{H}_3\text{O}^+ + e(\text{Me}) \rightarrow \text{H}_2\text{O} + \text{H}(\text{Me})$, by which the val. of the overvoltage of H is determined, is discussed. The distance between the electron cloud of the surface atoms of the metal and the min. of the potential energy curve for different models and orientations of H_3O^+ is discussed. A. J. M.

Electrolytic antimony.—See B., 1943, I, 125.

Chemical action of electric discharges. XXX. Production of acetylene and other hydrocarbons by means of the continuous and alternating arc (high- and low-frequency) operating between carbon electrodes in an atmosphere of hydrogen. J. J. Kündig and E. Briner (*Helv. Chim. Acta*, 1942, 25, 1251—1255).—The use of a high-frequency arc (10⁷ cycles per sec.) at low intensity, the optimum conditions for the synthesis of NO, NH₃, and HCN, gives only low yields of C₂H₂ (>0.5 g. per kw.-hr.). The best yields (>1 g. per kw.-hr.) are obtained with a low-frequency (50 cycles per sec.) arc of relatively high intensity, suggesting that the formation of C₂H₂ is a thermal reaction and is independent of the action of electrons. J. W. S.

Cyclotron targets. Preparation and radiochemical separations. I. Arsenic and germanium. J. W. Irvine, jun. (*J. Physical Chem.*, 1942, 46, 910—914).—Radio-As has been made by a (*d*, *n*) reaction involving cyclotron bombardment of a Ge—Cu alloy on a probe target: $^{72}_{32}\text{Ge} + ^1_1\text{H} \rightarrow ^{73}_{33}\text{As} + ^0_0\text{n}$. The product has a 16-day half-life. An isotope with half-life 50 hr. is formed at the same time. The prep. of As-free radio-Ge is described. C. R. H.

Photochemical oxidation of carbonyl sulphide. V. N. Kondrateev (*Acta Physicochim. U.R.S.S.*, 1942, 16, 272—281).—Mixtures of COS vapour and O₂ were illuminated with light, from a H discharge tube, of $\lambda > 2300 \text{ \AA}$. Determinations were made from room temp. to 100° with mixtures of different compositions and pressures (12—46 mm.), and with different intensities of radiation. The mechanism of the reaction is considered to be: $\text{COS} + h\nu = \text{CO} + \text{S}$; $\text{S} + \text{COS} = \text{CO} + \text{S}_2$; $\text{S}_2 + \text{O}_2 = \text{SO}_2 + \text{S}$; $\text{S} + \text{SO}_2 = \text{S}_2\text{O}_2$; $\text{S}_2\text{O}_2 \rightarrow (\text{wall}) \text{SO}_2 + [\text{S}]$. It was found that $[\text{SO}_2] = k_0 \sqrt{I t} e^{-3000/RT} [\text{COS}]$, where k_0 is const., I = intensity of discharge, and t = time of irradiation. A. J. M.

Theory of chemical development. V. Anastasevitch (*Acta Physicochim. U.R.S.S.*, 1942, 16, 296—306).—The chemical development of photographic films is discussed. A theory is based on the conception that development is similar to the formation of *F*-centres in crystals of alkali halides when exposed to the vapours of the alkali metals. The velocity of reduction of the Ag halides is obtained. The theory explains the selective development of exposed AgBr grains and the ultimate development of AgBr that has not been exposed. It also explains the retarding action of KBr and oxidation products of the developer on the velocity of reduction. A. J. M.

Olefine-oxygen-hydrogen bromide photo-reaction.—See A., 1943, II, 78.

Photo-addition of hydrogen bromide to olefinic linkings.—See A., 1943, II, 78.

Photo-addition of hydrogen sulphide to olefinic linkings.—See A., 1943, II, 80.

Effect of specific poisons on photo-reduction with hydrogen in green algae. Fermentative and photochemical production of hydrogen in algae.—See A., 1943, III, 217, 218.

IX.—PREPARATION OF INORGANIC SUBSTANCES.

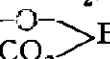
Separation of helium from neon. E. K. Gerling and G. M. Ermolin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 641—643).—He and Ne are quantitatively separated by adsorbing Ne on coal at −225°. The amount of He adsorbed is not great. W. R. A.

Acids and bases. Their relationship to oxidising and reducing agents. W. F. Luder (*J. Chem. Educ.*, 1942, 19, 24—26).—An electronic interpretation, and an extension of views previously advanced (*Chem. Rev.*, 1940, 27, 547). L. S. T.

Hydrogen peroxide formation on the adsorption of acids by activated charcoal. R. Burscht ein and A. Frumkin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 327—329).—10 c.c. of aq. H₂SO₄ were added to 0.5 g. of charcoal, and O₂ was passed through the mixture. After filtration through a glass filter the adsorbed anion was determined by titration with standard alkali and H₂O₂ by KMnO₄. As [H₂SO₄] is increased the yield of H₂O₂ rises. H₂O₂ is, however, formed only when gaseous O₂ is present; in the cathodic reduction of O₂ with C electrodes the rate of formation of H₂O₂ depends on the c.d. W. R. A.

Boric acid and hydroxy-compounds. II. Salts of monosalicylyl-boric acid. H. Schäfer (*Z. anorg. Chem.*, 1942, 250, 96—109).—The

following monosalicylylborates and disalicylyltriborates are described: LiR, 1.75H₂O; KR, 2H₂O; MgR, 4H₂O; CoR, 4H₂O; NiR, 4H₂O; ZnR, 4H₂O; Na₂R, HBO₂, 6H₂O; BaR, HBO₂, 2H₂O;

CdR, HBO₂, 5H₂O (R = C₆H₄—BO). The solubilities of some salicylates are recorded as follows (X = OH·C₆H₄·CO₂): CoX, 4H₂O, 0.42; NiX, 4H₂O, 0.38; ZnX, 2H₂O, 0.24; CdX, 2H₂O, 0.063; PbX, H₂O, 0.011; AgX, 0.004 equiv. per l. F. J. G.

Mechanism of copper passivation in alkaline solutions of oxidisers. A. G. Samartzev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 35, 38—42).—The passivation of Cu in alkaline K₂S₂O₈ is due to a film of CuO deposited on the surface by decomp. of Na₂CuO₂ at first formed in solution. F. J. G.

Polymorphism of calcium carbide. M. A. Bredig (*J. Physical Chem.*, 1942, 46, 801—819).—S- and N-free CaC₂ I, II, and III have been prepared in the electric arc furnace and their thermal conditions of stability have been investigated. Samples quenched from temp. >450±10° and held at that temp. gave CaC₂ III whether mechanically deformed by grinding or not. After grinding at lower temp. neither CaC₂ III nor II was obtained except in minor quantities. When ground at room temp. the samples acquired the CaC₂ II structure, when ground at 350—450° 80% of CaC₂ I was obtained, and when ground at >500° CaC₂ III was the product. Experiments with the high-temp. X-ray camera reveal the existence of CaC₂ IV which has a face-centred cubic space lattice with $a_0 = 5.92 \text{ \AA}$. at 480°, the unit cell containing 4 mols. of CaC₂. A phase diagram has been constructed and is discussed, and comparison is made with SrC₂ and BaC₂. The influence of impurities has been examined. C. R. H.

Change in properties of zinc oxide and chromic oxide during their combination. G. F. Hüttig and H. Theimer (*Kolloid-Z.*, 1942, 100, 162—163).—Equimol. mixtures of ZnO and Cr₂O₃, preheated at different temp., show an increased tendency to be oxidised to chromate over a temp. range <600° to >1000° for those temp. of pre-heating which have been shown to be effective in enhancing the activity of the oxides (cf. A., 1942, I, 274). F. L. U.

Active substances. LV. Physical inhomogeneity of active solids. R. Fricke (*Kolloid-Z.*, 1942, 100, 153—158; cf. A., 1942, I, 404).—Preps. of active ZnO and Fe₂O₃ were caused to undergo a partial reaction (ZnO with aq. KOH, Fe₂O₃ with aq. HF, and with H₂O to give FeO·OH), during which the most active portions would be expected to react preferentially. Determinations of the heat of dissolution of the specimens before and after reaction showed the activity of the original specimen to be > that of the residue in each case. The effect was proved to be not due to differences of particle size. F. L. U.

Extraction of rare earth and beryllium compounds from gadolinite. W. Fischer [with P. Herbach, H. Plempe, and G. Wirths] (*Z. anorg. Chem.*, 1942, 250, 72—81).—The mineral is broken up by evaporation with HCl, and after filtration from SiO₂ the greater part of the rare earths is pptd. by H₂C₂O₄. Then after oxidation of H₂C₂O₄ with KMnO₄ and reduction of Fe^{III} to Fe^{II} with SO₂, the rest of the rare earths and the Be are pptd. by NH₃ in a H₂ atm. and the Be is separated by distillation as basic acetate. F. J. G.

Preparation of pure scandium compounds. W. Fischer and R. Bock (*Z. anorg. Chem.*, 1942, 249, 146—197).—Methods for the separation of Sc from the rare earths, Al, Fe, Th, and Zr have been critically studied. Pptn. reactions are all unsatisfactory because of incomplete separation or loss of Sc. Sublimation methods are troublesome and require complicated apparatus. Sc(CNS)₃ is extracted from H₂O by Et₂O, and this affords a good separation. F. J. G.

Rare earth metal amalgams. III. Separation of ytterbium from its neighbours. J. K. Marsh (*J.C.S.*, 1943, 8—10).—YbOAc readily forms a very reactive amalgam which is more electropositive than Sm amalgam; since LuOAc and TmOAc solutions do not form amalgams this property has been used to separate Yb from Lu and Tm and to obtain it in a pure state. J. L. E.

Yttrium-group oxalates. J. K. Marsh (*J.C.S.*, 1943, 40—41).—Some hydrates of the oxalates of Dy, Y, Er, and Yb are described, including the hydrates Y₂(C₂O₄)₃·6 and 10H₂O and Yb₂(C₂O₄)₃·6H₂O. The commonly cited nonhydrate of Y₂(C₂O₄)₃ is a complex NH₄ salt. J. L. E.

Reduction of carbon dioxide coupled with oxyhydrogen reaction in algae.—See A., 1943, III, 218.

Reaction between nitric oxide and vanadous salts. L. Malatesta (*Gazzetta*, 1941, 71, 615—620).—VSO₄·(NH₄)₂SO₄·6H₂O and VSO₄·K₂SO₄·6H₂O [new prep. from V₂O₅, H₂SO₄, aq. SO₂, and electrolysis, followed by (NH₄)₂SO₄ or K₂SO₄] with NO and H₂O at 0—40° undergo the reaction: $5\text{V}^{III} + \text{NO} + 5\text{H}^+ \rightarrow 5\text{V}^{IV} + \text{NH}_3 + \text{H}_2\text{O}$. The intermediate formation of [V(NO)]²⁺ is suggested; in presence of NEt₂·CS₂·Na the unstable diamagnetic compound, V(NO)(CS₂NEt₂)₂, is formed. E. W. W.

Lower vanadium oxides. W. Klemm and L. Grimm (*Z. anorg. Chem.*, 1942, 250, 42—55).—Contrary to the findings of Mathewson

et al. (*Trans. Amer. Soc. Steel Treat.*, 1932, **20**, 357) the lattice of V is tetragonally deformed by absorption of O. VO has a 4-11. At lower temp. it decomposes to V and a higher oxide. F. J. G.

Polythionic acids and their formation. V. Reactions of the sulphur chlorides. M. Goehring and H. Stamm [with U. Feldmann] (*Z. anorg. Chem.*, 1942, **250**, 56—71).—The hydrolysis of S_2Cl_2 and SCl_2 and their reactions with H_2SO_3 and $H_2S_2O_3$ have been studied. In addition to S , SO_3'' , and S_2O_3'' , the hydrolysis of S_2Cl_2 in acid but not in alkaline solution affords much polythionic acids, especially $H_2S_5O_6$. The reaction between S_2Cl_2 and H_2SO_3 in strongly acid solution affords chiefly $H_2S_4O_6$, but in less acid medium this is increasingly broken down to $H_2S_3O_6$ and $H_2S_2O_3$ by further reaction with H_2SO_3 . With $H_2S_2O_3$, S_2Cl_2 affords primarily $H_2S_4O_6$. Hydrolysis of SCl_2 in acid solution affords $H_2S_3O_6$ and higher polythionic acids, in alkaline solution $H_2S_2O_3$ and H_2SO_3 , and always some free S . The chief product of reaction between SCl_2 and H_2SO_3 is $H_2S_3O_6$, as in the reaction between $S(NEt_2)_2$ and H_2SO_3 . With SCl_2 and $H_2S_2O_3$ the chief product is $H_2S_5O_6$. It is concluded that the chief intermediate product in Wackenroder's solution is $H_2S_2O_2$, and that H_2SO_2 plays at most a minor part in the side reactions. F. J. G.

Dioxanate of iodine pentafluoride.—See A., 1943, II, 102.

Reactions of solid substances. CXXX. Outgassing of iron powders of different origin and history. G. F. Hüttig and H. H. Bludau (*Z. anorg. Chem.*, 1942, **250**, 36—41).—The amounts of gases present in various samples of Fe powder, and the course of their evolution on heating, depend greatly on the origin and history of the sample. In general gas is evolved preferentially at 200°, 400°, and 710°.

Reactions of solid substances. CXXVI. Outgassing of solid substances. G. F. Hüttig [with H. Theimer and W. Breuer] (*Z. anorg. Chem.*, 1942, **249**, 134—145).—The evolution of volatile impurities from powdered Fe, Cu, Sn, and α - Al_2O_3 at various temp. has been studied. It occurs chiefly in the regions $\alpha \sim 0.29$ and $\alpha \sim 0.43$ (α = temp. expressed as fraction of the m.p. in °K.), which correspond with the activation (loosening) of the surface and of the interior of the lattice. F. J. G.

Iridium aminosulphite compounds. V. V. Lebedinski and M. M. Gurin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **33**, 241—243).— Na_2Ir triaminosulphite, $Na_3Ir(SO_3)_3(NH_3)_3 \cdot 7H_2O$ (I), has been prepared by the action of aq. NH_3 on $Na_2Ir(SO_3)_4Cl_2$. The displaced Cl atoms are made labile by the presence of (SO_3) groups in the *trans*-position. (I) gives three ions, and its structure is probably $Na_2[NaSO_3 Ir(SO_3)_2(NH_3)_3] \cdot 7H_2O$. It closely resembles the corresponding Rh salt. With $Zn(NO_3)_2$ (I) gives $Zn[NaSO_3 Ir(SO_3)_2(NH_3)_3] \cdot 5H_2O$. A. J. M.

Reactions with thiosulphate as a method for determining the nature of isomerism of platinum complex compounds. D. I. Riabtschikov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 344—346).—When a mixed tetrammine of Pt is treated in solution with 1 mol. of $Na_2S_2O_3$ to each atom of Pt, the *cis*-isomeride yields $[Pt 2NH_3 S_2O_3]$ whilst the *trans*- gives $[Pt 2NH_3 S_2O_3 \cdot H_2O]$. With excess of $Na_2S_2O_3$ *cis*- gives $Na_6[Pt(S_2O_3)_4]$, and *trans*- gives $Na_2[Pt 2NH_3 (S_2O_3)_2]$ unless a very great excess of $Na_2S_2O_3$ and prolonged vigorous heating are used, when complete substitution of (S_2O_3) groups takes place. The reaction has been tested with the following isomeric compounds: $[Pt 2NH_3 X_2]$ ($X = Cl, Br, I, NO_2$); $[Pt (C_5H_5N)_2 Cl_2]$; $[Pt 2NH_3 C_2O_4]$; $[Pt 2NH_3 (HC_2O_4)_2]$; *cis*- $[Pt 2NH_3 Cl NH_2SO_3]$. W. R. A.

Mechanism of oxidation of thiosulphate compounds of platinum. D. I. Riabtschikov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **33**, 233—236).—The oxidation of $K_2[Pt 2NH_3 (S_2O_3)_2]$ (I) and $K_2[Pt S_2O_3 Cl_2]$ (II) by $KBrO_3$ has been investigated, the compounds being chosen because the (S_2O_3) is linked in them in two distinct ways. The process was followed by electrometric titration. In the oxidation of $Na_2S_2O_3$ itself by $KBrO_3$ there are two stages: (1) $2Na_2S_2O_3 + O + 2HCl = Na_2S_4O_6 + H_2O + 2NaCl$; (2) $2Na_2S_4O_6 + 14O + 6H_2O = 2Na_2SO_4 + 6H_2SO_4$. When (I) is oxidised with $KBrO_3$, S separates at first, after which the Pt is oxidised. Finally the S is oxidised to H_2SO_4 : $K_2[Pt 2NH_3 (S_2O_3)_2] + 9O + 6HCl + H_2O = [Pt 2NH_3 Cl_4] + 4H_2SO_4 + 2KCl$. (II) is oxidised as follows: $K_2[Pt S_2O_3 Cl_2] + 5O + 4HCl = K_2PtCl_6 + 2H_2SO_4$. A. J. M.

Hydroxylamine compounds of platinum and palladium. V. I. Goremikin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 633—636).—Interaction of 10% HF, HCl, HBr, and HI with $[Pt(NH_2OH)_4](OH)_2$ and of 1% solutions of the acids with $[Pd(NH_2OH)_4](OH)_2$ has been studied. HF yields tetrammines, HCl gives a tetrammine with Pt and a mixture of a tetr- and a di-ammine with Pd, HBr gives a mixture of amines with Pt but only the diammine with Pd, and HI gives the mixture with Pt but no ammine with Pd, only PdI_2 and $NH_2OH \cdot HI$. The following compounds have been prepared and their principal reactions are discussed: $[Pt(or Pd)(NH_2OH)_4](HF_2)_2 \cdot 2H_2O$; $[Pt(NH_2OH)_4]Br_2$ (or I_2); $[Pd(NH_2OH)_4]Cl_2$; *trans*- $[Pd(NH_2OH)_2Br_2]$. The nature of reaction products appears to be related to the strength of the Pt (Pd) $\cdots NH_2OH$ bond. W. R. A.

Hydrazine compounds of platinum and palladium. V. I. Goremikin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **33**, 227—230).—When

K_2PtCl_4 and K_2PdCl_4 , either solid or in dil. aq. solution, are added to a saturated solution of $N_2H_4 \cdot 2HCl$, compounds $[PtCl_2 \cdot 2N_2H_5]Cl_2 \cdot 2H_2O$ (I) and $[PdCl_2 \cdot 2N_2H_5]Cl_2 \cdot 2H_2O$ (II) are formed. (I) forms yellow or orange plates. When an aq. solution of (I) is mixed with aq. NH_3 , reduction to Pt takes place. Treatment of (I) with C_5H_5N gives $[PtCl_2 \cdot 2N_2H_4]$. Excess of C_5H_5N causes reduction to Pt. $[PdCl_2 \cdot 2N_2H_4]$ crystallises in orange-coloured square laminae, and combines with HCl to form (II), which gradually loses H_2O on exposure to air, but is not greatly affected by temp. Heating at 105° converts it into the compound $[PdCl_2 \cdot N_2H_4 \cdot N_2H_5]Cl$. If dil. aq. K_2PdCl_4 is treated with $N_2H_4 \cdot 2HCl$, an amorphous, orange yellow ppt. is formed which is probably $[PdCl_2 \cdot N_2H_4]$. It is possible that this compound may be associated as follows: $[Cl > Pd < NH_2-NH_2 > Pd < Cl]$. The compound $[PtCl_2 \cdot N_2H_4 \cdot N_2H_5]Cl$ has also been obtained. A *cis*-configuration is ascribed to all these compounds. A. J. M.

X.—ANALYSIS.

Precision in spectrochemical analysis. H. B. Vincent and R. A. Sawyer (*J. Opt. Soc. Amer.*, 1942, **32**, 686—692).—Statistical methods for the separation and treatment of uncertainties entailed in various steps of the analytical process are developed and illustrative data are tabulated. N. M. B.

Quantitative molecular spectral analysis.—See A., 1943, I, 51.

Spot tests in the teaching of chemistry. F. Feigl (*An. Assoc. Quim. Brasil*, 1942, **1**, 234—242).—A review. F. R. G.

Analytical reactions involving ignition with manganous nitrate. M. J. Preising, O. F. Slonek, and J. H. Reedy (*Ind. Eng. Chem. Anal.*, 1942, **14**, 875—877).—Many anions are oxidised when evaporated with conc. aq. $Mn(NO_3)_2$ and ignited. MnO_2 is the oxidising agent. ClO_4' is detected as Cl' by heating with 50% aq. $Mn(NO_3)_2$; 0.1 mg. of ClO_4' in presence of 100 mg. of ClO_3' or Cl' can be identified by the procedure described. Reduction to Cl' is quant. Reduction to Cl' by Ti''' (A., 1909, ii, 434) is incomplete. Cl' in presence of CNS' can be detected after oxidation of CNS' by similar treatment with $Mn(NO_3)_2$. The test is sensitive to 35.5 $\mu g.$ of Cl' in presence of 3.5 mg. of CNS' , and is better than oxidation of CNS' by HNO_3 , which results in loss of Cl , or removal of CNS' as $CuCNS$. L. S. T.

Preparation of "N/10-bromine." A. G. Fishburn and M. J. Smith (*Pharm. J.*, 1943, **150**, 76).—A solution containing $KBrO_3$ (3 g.) + KBr (10 g. per l.) satisfactorily replaces the B.P. proportion for the determination of NH_2 -compounds. For $PhOH$, 5 g. of KBr suffices. A. A. E.

Determination of Hanus iodine value [of benzene] by arsenometric titration.—See B., 1943, I, 100.

Colorimetric determination of fluorine in simple and complex fluorides by means of zirconium-alizarin lake. I, II. F. Richter (*Z. anal. Chem.*, 1942, **124**, 161—192, 192—216).—The effect of various factors on the course of the reaction has been investigated, and methods for determining F in sol. and insol. fluorides have been worked out. Data for samples of both types are recorded. In the F' -lake reaction the liberated alizarin (I) stands in a definite relationship to $[F']$. The colloiddally-dispersed lake coagulates during the reaction at diminishing $[Zr]$, especially in presence of $NaCl$. The coagulated lake is removed by filtration through a layer of kieselguhr on a sintered glass mat, and the liberated (I) determined photometrically. Liberation of (I) depends on $[HCl]$. SO_4'' is removed by aq. $BaCl_2$. The reaction depends also on the kind and duration of heating, and a suitable heating schedule is given. Dissolution of insol. fluorides containing >15% F is accomplished by heating with $Na_2B_4O_7$ and HCl in a specially-designed flask. Sol. fluorides are distilled with $HClO_4$ in a special apparatus, and the F is obtained as SiF_4 or HF . A correction for interference due to $SiO_2 \cdot nH_2O$ in the gel form is necessary. The distillation process is recommended as an umpire method. L. S. T.

Determinations of low concentrations of oxygen in gas. J. A. Shaw (*Ind. Eng. Chem. Anal.*, 1942, **14**, 891—892).—A method for determining several thousandths of 1% of O_2 in gases is described. The sample is shaken in a flask of special design with $Fe(OH)_2$ freshly pptd. by $NaOH$ from O_2 -free acid $Fe^{II} NH_4$ sulphate. The Fe''' is determined colorimetrically by means of $KCNS$. The method is suitable for gases containing highly unsaturated or easily condensed hydrocarbons. L. S. T.

Micro-determination of sulphur and halogens by melting with potassium. II. K. Bürger (*Chemie*, 1942, **55**, 245—247).—The author's method (A., 1942, I, 276) is simplified and described in detail. Minerals must be very finely ground, but the method is suitable for S and halogen determinations on all types of org. and inorg. compounds. Na is preferred to K for treating org. compounds rich in N to minimise CN' formation. The method is accurate to $\pm 0.1\%$ S and $\pm 0.3\%$ Cl with 5—10-mg. samples. M. H. M. A.

Determination of sulphur in acid-soluble sulphides. H. C. Froelich (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 900).— H_2S is liberated by the action of 50% H_2SO_4 and distilled into ammoniacal AgNO_3 . The excess of Ag^+ is determined by titration either with alkali cyanide solution (indicator AgI) or with alkali chloride (fluorescein) in neutral solution. L. S. T.

Determination of selenium, tellurium, and arsenic in commercial copper.—See B., 1943, I, 124.

Determination of tellurium in lead and in antimony-lead alloys.—See B., 1943, I, 125.

Rapid Kjeldahl digestion method using perchloric acid. L. P. Pepkowitz, A. L. Prince, and F. E. Bear (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 856—857).—After the usual digestion of plant materials and fertilisers with H_2SO_4 , SeOCl_2 , and Na_2SO_4 , 0.5—1 ml. of 35% aq. HClO_4 is added, and the digestion continued at < b.p. to prevent loss of N. With soils, the Na_2SO_4 is omitted to prevent the same loss. The average digestion time for a 1-g. sample is 30 min. The results obtained for 33 materials other than soils agreed with those obtained by independent analysts using the A.O.A.C. method. L. S. T.

Kjeldahl nitrogen determination. Rapid wet-digestion method. L. P. Pepkowitz and J. W. Shive (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 914—916).— HClO_4 (35%) is added after digestion with H_2SO_4 and SeOCl_2 as catalyst, or if nitrates are to be included, after treatment with salicylic acid- H_2SO_4 solution, aq. $\text{Na}_2\text{S}_2\text{O}_8$, and SeOCl_2 . Addition of HClO_4 at the beginning of the digestion always results in loss of N. Digestion must be completed at temp. < b.p. Data for N in pure compounds and for N in org. material are recorded. The latter show agreement with results obtained by the A.O.A.C. method. For 10-mg. samples, time of digestion is reduced from 2 hr. by the A.O.A.C. method to 12 min. by the new method. L. S. T.

Diffusion micro-method for [determination of] nitrogen. R. C. Hawes and E. R. Skavinski (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 917—921).—An ordinary test-tube is used as digestion and diffusion vessel. Digestion is effected by H_2SO_4 containing SeO_2 and CuSO_4 , and H_2O_2 is added near the end. The diffusion receiver is a helix of Pt wire carrying a drop of 1.0M- NaH_2PO_4 as absorbent, and is held in the test-tube by a grooved rubber stopper. The final titration is electrometric, or with bromocresol green-Me-red as indicator, which is preferred to methylene-blue-Me-red. L. S. T.

Elimination of fluoride interference in the molybdenum-blue reaction [for phosphate]. L. T. Kurtz (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 855).—Interference is prevented by adding H_3BO_3 . Neither excess of H_3BO_3 nor BF_4^- interferes with the Dickman-Bray procedure for determining PO_4^{3-} (A., 1942, I, 71). L. S. T.

Determination of pyrophosphate by precipitation with cadmium and polarographic measurement of cadmium in the precipitate. G. Cohn and I. M. Kolthoff (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 886—890).— $\text{Cd}_2\text{P}_2\text{O}_7$ is pptd. at pH 3.6. It can be weighed in the anhyd. form after drying to const. wt. at 250° , or dissolved in dil. HCl and Cd^{2+} determined polarographically. Details of procedure and of the effect of conditions on pptn. are given. A method for determining 0.002—0.01M-pyrophosphate in presence of 4—16 times the M. concn. of PO_4^{3-} and from 8 to 32 times that of Ca^{2+} is described. Polarographic determinations show that the solubility of $\text{Cd}_2\text{P}_2\text{O}_7$ in H_2O is negligible; it is appreciable in 0.1M- KCl and in 0.1M- $\text{KCl} + \text{AcOH-NaOAc}$ buffer (pH 6.1). L. S. T.

Rapid determination of total phosphorus in soil and plant material.—See B., 1942, III, 45.

Spectrochemical determination of silicon, iron, and aluminium in mineral powders with a high-voltage direct-current arc. H. I. Oshry, J. W. Ballard, and H. H. Schrenk (*J. Opt. Soc. Amer.*, 1942, **32**, 672—680).—The technique described is adapted for the determination of atm. contamination; it requires 1—12 mg. of the sample, can be used for concns. of ~1—100% of the elements determined, and is accurate to ~5% of the total components. The sample is diluted in a known amount of specially purified NiO , and the SiO_2 , Fe_2O_3 , and Al_2O_3 are determined as impurities in the NiO . Illustrative data for various samples are compared with those obtained chemically. N. M. B.

Analytical studies on some 12-heteropoly-acids. I. Determination of silicon in presence of molybdic acid. A. R. Tourky and H. K. El Shamy (*Analyst*, 1943, **68**, 2—5).—Excess of $\text{H}_2\text{C}_2\text{O}_4$ prevents the formation of silicomolybdate complexes and permits the determination of SiO_2 in presence of Mo. S. B.

Photometric determination of silica in presence of phosphates. M. C. Schwartz (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 893—895).—In the procedure described, interference due to phosphomolybdic acid is removed by adding oxalic acid. Under the conditions specified, K_2CrO_4 standards provide a good colour match for the silicomolybdic acid solutions at $\lambda > 410 \mu$. L. S. T.

Colorimetric determination of silicon in aluminium alloys.—See B., 1943, I, 128.

Application of the polarising microscope [to the qualitative study of reactions]. G. W. Thiessen and L. F. Beste (*J. Chem. Educ.*, 1942, **19**, 331—332).—The formation of KClO_3 or KBrO_3 during electrolysis of aq. KCl or KBr , respectively, can be followed by microscopical examination of drops of solution removed at intervals during the electrolysis. L. S. T.

Determination of potassium [as perchlorate] in calcareous Nitrophoska.—See B., 1943, I, 111

Quantitative separation of calcium from strontium using acetone as a solvent. M. M. Tillu and M. S. Telang (*J. Indian Chem. Soc.*, 1942, **19**, 231—232).—The solubility of $\text{Sr}(\text{NO}_3)_2$ in COMe_2 at 25° is ~1:15,000, whereas $\text{Ca}(\text{NO}_3)_2$ is readily sol. This affords a quant. separation of Ca from Sr. F. J. G.

Agar-agar as coagulant for barium sulphate. E. J. Bogan and H. V. Moyer (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 849—850).—The positively-charged BaSO_4 obtained when SO_4^{2-} is pptd. by an excess of Ba^{2+} is coagulated by addition of agar (1 mg. per 0.1 g. of BaSO_4). The charge on the particles is reversed in sign. BaSO_4 obtained by pptg. Ba^{2+} with SO_4^{2-} is not appreciably improved. Creeping is eliminated by addition of agar. Data showing the effect of agar on time of settling of ppts. of BaSO_4 , and the mobilities of the particles, are recorded graphically. L. S. T.

Determination of magnesium in solution of citrate of magnesia.—See B., 1943, III, 61.

o-Dianisidine as internal indicator for zinc-ferrocyanide titrations. H. F. Frost (*Analyst*, 1943, **68**, 51).—o-Dianisidine in H_2SO_4 gives a sharp end-point colour change from red-brown to pale blue-green in presence of sufficient $\text{Fe}(\text{CN})_6^{4-}$. S. B.

Micro-determination of lead by dithizone, with an improved lead-bismuth separation. K. Bambach and R. E. Burkey (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 904—907).—Modifications of the method previously described (A., 1939, I, 488) are discussed. The time-consuming Bi test is eliminated by working at pH 3.4, when Pb and Bi are separated. Details of procedure for determining Pb in biological materials, including prep. of samples and purification of reagents, are given. Standard dithizone solutions can be preserved without apparent deterioration in glass-stoppered Pyrex bottles, in the dark and in a refrigerator. L. S. T.

Detection and semi-quantitative estimation of group I cations. S. S. Leikind, R. Maurmeyer, and M. Cutler (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 871).— PbCl_2 is extracted by means of $\text{NH}_4\text{OAc} + \text{AcOH}$, the residue is treated with aqua regia, and after dilution with H_2O , AgCl is removed from the HgCl_2 in solution. The method is suitable for detecting 100 mg. of metal as max., with the lower limit of 0.2 mg. for Ag and Hg, and 15 mg. of Pb, each metal alone or in presence of each other. L. S. T.

Determination of copper with quinoline-8-carboxylic acid. J. R. Gilbreath and H. M. Haendler (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 866—867).— Cu^{2+} is pptd. in neutral or slightly acid (AcOH) solution by means of aq. quinoline-8-carboxylic acid, and weighed as $(\text{C}_8\text{H}_6\text{NCO}_2)_2\text{Cu}$ after drying at 110 — 120° . In presence of Cd or Zn, pptn. is effected at pH 3.5—4.0 (litmus and 0.1N- AcOH). With 50 mg. of Cu and a four-fold excess of Cd the accuracy is 0.1—0.15%. Ag and Au give insol. ppts. and must be absent; Pb, Ni, Hg, and Co do not interfere under the conditions described. L. S. T.

Stability of the cupric-ammonia colour system. J. P. Mehlig (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 903).—The colour of this system was found to be practically unchanged after 57 weeks (cf. A., 1941, I, 483). When Pyrex containers are used, any action of NH_3 on the glass is negligible. L. S. T.

New precipitant for group II ions. S. Gaddis (*J. Chem. Educ.*, 1942, **19**, 327—328).—In semi-micro-analyses a resin, Amberlite IR-4, saturated with H_2S , is introduced into the 0.35N- HCl solution obtained after removal of group I. L. S. T.

Simplified technique in the use of liquid amalgam reductors. G. F. Smith and L. T. Kurtz (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 854—855).—After shaking the solution and amalgam for 2 min., CCl_4 is added and separates the amalgam completely from the solution being analysed, which is then titrated in presence of CO_2 . The chief difficulty encountered in the Nakazona-Someya methods is thus eliminated. Procedure and data for determining Fe, and Fe + Ti, are given. L. S. T.

Analytical chemistry of rhenium. A. Voigt (*Z. anorg. Chem.*, 1942, **249**, 225—228).—Working details are given for electrolytic determination of Re from ammoniacal solution, and for a rapid separation of Re from Mo by pptn. with H_2S . F. J. G.

Colorimetric determination of iron with 2:2'-dipyridyl and with 2:2':2''-tripyridyl. M. L. Moss with M. G. Mellon (*Ind. Eng. Chem. [Anal.]*, 1942, **14**, 862—865).—Max. absorption in the o-phenanthroline-, 2:2'-dipyridyl-, and 2:2':2''-tripyridyl- Fe^{2+} complexes occurs at 510, 522, and 552 μ , respectively. Working ranges of pH are 3—9, 3—9, and 3—10, respectively. At max. absorption Beer's law holds for the di- and tri-pyridyl systems.

$\text{NH}_2\text{OH}\cdot\text{HCl}$ is used to reduce Fe^{+++} ; good results are also obtained with TiCl_3 , quinol, and ascorbic acid, but N_2H_4 and SO_2 are not recommended. The effects of numerous ions on both methods are listed, and a procedure for the colorimetric determination of Fe is detailed. L. S. T.

Detection of ferrocyanide ion with quinone chloroimide. E. W. Blank (*J. Chem. Educ.*, 1942, 19, 321).—EtOH-benzoquinone chloroimide gives an emerald-green colour or a dark brown ppt. Strong oxidising agents, but not $\text{Fe}(\text{CN})_6^{4-}$, interfere. The test will detect 5 μg . of $\text{Fe}(\text{CN})_6^{4-}$. L. S. T.

Colorimetric determination of cobalt. R. J. DeGray and E. P. Rittershausen (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 858—859).—The ammoniacal $\text{Fe}(\text{CN})_6^{4-}$ method is modified to control the nature and concns. of salts present, and to give a precision of 0.06 mg. of Co without exact measurement of the vols. of reagents added. The method is suitable for 0.5—4.0 mg. of Co. L. S. T.

Use of phosphate for separating cobalt from iron. V. North and R. C. Wells (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 859—860).—In the analysis of rocks, minerals, and ores, SiO_2 and group II metals are removed as usual, and then Fe^{+++} is pptd. as FePO_4 from an AcOH solution at pH 3.5. Co in the filtrate is pptd. by α -nitroso- β -naphthol and weighed as Co_3O_4 , or determined colorimetrically with CNS'. Ca, Mg, Al, and the alkalis do not interfere. Bi, Ti, Zr, and Hf are completely pptd. with Fe, but do not retain Co. Cu, Ni, Ba, and Sr are not pptd. with the Fe. Cr is incompletely pptd. Al is incompletely pptd., but does not interfere with the determination of the Co. Typical data for synthetic mixtures and representative ores are given. L. S. T.

Sodium perborate as a replacement for sodium peroxide in the chemical laboratory. C. F. H. Allen and J. H. Clark (*J. Chem. Educ.*, 1942, 19, 72).— $\text{NaBO}_3\cdot 4\text{H}_2\text{O}$ can, with advantage, replace Na_2O_2 in separating Cr^{+++} and Al^{+++} from Fe^{+++} . It can be used for the cleavage of α -diketones. L. S. T.

Analytical studies on 12-heteropoly-acids. II. Potentiometric titration of molybdate in presence of silicic or phosphoric acid. A. R. Tourky and H. K. El Shamy (*Analyst*, 1943, 68, 40—44).— Mo^{VI} is titrated in an atm. of CO_2 with TiCl_3 or CrCl_2 , giving a sharp inflexion at the transformation into Mo^{V} . H_3PO_4 and silicic acid do not interfere when in presence of sufficient $\text{H}_2\text{C}_2\text{O}_4$. S. B.

XI.—APPARATUS ETC.

Identification of very small amounts of liquids. R. Fischer (*Chemie*, 1942, 55, 244—245).—Determination of b.p. by the Emich micro-method is improved by using a capillary containing powdered glass to entrap several air bubbles. The liquid is further characterised by immersion in it of glass powder of (known) n slightly < that of the liquid at room temp. Optical disappearance of the glass on heating gives vals. of n_{liquid} which may be used directly or calc. (from results with two different glasses) to n_{liquid} at 20°. NaF, LiF, or cryolite can be used for liquids of low n , and Na light should always be used. B.p. and n can both be determined with ~ 2 cu. mm. of liquid. M. H. M. A.

Resonance thermocouples used for the investigation of complete radiation in the ultra-Hertz band. A. A. Glagoleva-Arkadieva and N. A. Sokolov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 543—545).—Air-filled and evacuated thermocouple units designed for detection of electromagnetic waves of $\lambda \sim 0.03$ —19 cm. are described. Typical measurements of λ by an interference method, on radiation from a mass-oscillator (cf. A., 1943, I, 46), are reported. A. J. E. W.

Resolving power of light screens. H. Hinderer (*Z. Physik*, 1942, 119, 397—405).—The resolving power of various multi-cryst. light screens and a single-crystal screen when excited by ultra-violet light has been determined. It depends on the roughness of the surface and the scattering of the exciting and emitted light in the material. The vals. lie between 5 and 15 μ , and agree with those obtained by other methods. A. J. M.

Polarising accessories for microscopes. C. D. West (*J. Chem. Educ.*, 1942, 19, 66—70). L. S. T.

Plate holder for double exposures with the Siemens ultramicroscope. F. Frey (*Z. tech. Physik*, 1942, 23, 176—177).—The plate is replaced by two superposed films in a slightly modified holder, so that two successive exposures can be made without intermediate use of the vac. lock. A. A. E.

Van der Kolk method of determining refractive indices. R. C. Evans and N. F. M. Henry (*Min. Mag.*, 1942, 26, 267—271).—The side illumination of crystal fragments immersed in a liquid under the microscope is described for different positions of the sub-stage condenser and of a side screen. L. J. S.

Colour nomenclature in qualitative analysis. II. ISCC-NBS colour names. L. P. Biefeld and M. Griffing (*J. Chem. Educ.*, 1942, 19, 307—312; cf. A., 1942, I, 374). L. S. T.

Infra-red spectrograph with means for direct registration of absorption ratio and with linear wave-length scale. E. Lehrer (*Z. tech. Physik*, 1942, 23, 169—176).—The spectrograph for use in the region 1—14 μ . operates by means of a compensation method. Absorption curves are given for Δ^a -butylene, and data are given for the analysis of a mixture of n - and iso - C_4H_{10} . A. A. E.

Grating spectrograph of fabricated steel. J. W. Forrest and H. W. Straat (*J. Opt. Soc. Amer.*, 1942, 32, 669—671).—The mechanical structure of a welded Wadsworth-type instrument, free from vibration, is described. The unit uses a 4-m.-radius grating, 100 mm. long, ruled with 10,000 lines per cm. N. M. B.

Stigmatic grating spectrograph for industrial laboratories. R. F. Jarrell (*J. Opt. Soc. Amer.*, 1942, 32, 666—669).—A Wadsworth-type mounting is described and discussed. N. M. B.

Corrections for residual impurity and background in spectrochemical analysis. J. Cholak and R. V. Story (*J. Opt. Soc. Amer.*, 1942, 32, 502—505).—The background effect in spectroscopic analysis is eliminated by the method of Pierce and Nachtrieb (A., 1942, I, 117) with the additional precaution of using for comparison a standard Bi line in the same intensity range as the test line. The effects of residual impurities in the standard mixture and reagents are deduced by determination of the intensity ratios of the test line and comparison line at various known concns. of the metal in question and the comparison metal (Bi). J. W. S.

Significance of stray light in photo-electric filter photometers. M. N. States and J. C. Anderson (*J. Opt. Soc. Amer.*, 1942, 32, 659—666).—A theoretical analysis and experimental data show that variations in the shape of the analytical curves, relating concn. of material in solution to indications of the instrument, are due to the presence, variation in spectral region, and magnitude of stray light components. Conclusions on calibration and technique are summarised. N. M. B.

Testing of magnetic materials using a cathode-ray oscillograph with electrostatic deflexion only. K. Kreielsheimer (*J. Sci. Instr.*, 1943, 20, 32).—An addendum (cf. A., 1942, I, 378). A. A. E.

Electron microscope. Calibration and use at low magnifications. C. J. Burton, R. B. Barnes, and T. G. Rochow (*Ind. Eng. Chem.*, 1942, 34, 1429—1436).—The use of the electron microscope and optical and non-optical methods of calibration are discussed. C. R. H.

Intensity relations with the electron microscope. III. Suitability and limits of sensitivity of photographic plates for electron microscope photographs. B. von Borries (*Z. Physik*, 1942, 119, 498—521).—The suitability of photographic plates for electron microscope work is examined from the point of view of sensitivity, resolving power, and gradation. The energy necessary to cause blackening of a nucleus on development is calc., and the least possible exposure of the object to the electron beam in order to obtain a photograph is discussed. The heating and ionisation effects in the object, and the application to living objects, are considered. A. J. M.

Resolving power of the emission microscope. J. Dosse and H. O. Müller (*Z. Physik*, 1942, 119, 415—422).—The lower limit of the resolving power is obtained by consideration of the velocity distribution of electrons. If the field strength (E) in front of the cathode is increased, the resolving power at first decreases with $1/E$, but at high E it becomes const. and independent of E . The resolving power for a plane cathode is better than for a spherical one. A. J. M.

Simplified electron microscope. C. H. Bachman and S. Ramo (*Physical Rev.*, 1942, [ii], 62, 494).—The instrument is a combined electron and light microscope with unipotential electrostatic electron lenses. Advantages are briefly summarised. N. M. B.

Electron diffraction at small aperture in the universal electron microscope (method and results). M. von Ardenne, E. Schiebold, and F. Günther (*Z. Physik*, 1942, 119, 352—365).—Electron-optical arrangements for the exploration of minute regions in the object-plane of the universal electron microscope by means of a constricted electron beam are described. L. J. J.

Operation of proportional counters. S. A. Korff (*Rev. Mod. Physics*, 1942, 14, 1—11).—A survey of the theory, construction, and use of counters. Illustrative data and curves are given. N. M. B.

The coincidence method and its use in problems of nuclear physics. H. Maier-Leibnitz (*Physikal. Z.*, 1942, 43, 333—362).—A detailed report, with bibliography, on the construction, characteristics, operation, and application of coincidence counters and their associated apparatus. A. J. E. W.

Magnetic field of great homogeneity for the Wilson cloud chamber. K. Sauerwein (*Naturwiss.*, 1942, 30, 494—495).—Apparatus is described. F. J. G.

Measurement of dielectric constant in the centimetre band. A. N. Soos (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 210—212).—The method depends on the observation of the interference pattern between a source of monochromatic radiation (λ 5 cm.) and the speci-

men in the form of a plate. The method is applied to various dielectrics, including semi-conductors. A. J. M.

Expedients in laboratory glass working. R. H. Wright (*J. Chem. Educ.*, 1942, 19, 71—72). L. S. T.

Insulation for necks of wash bottles. J. Mizroch (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 845).—Asbestos strip lacquered with Bakelite is used. L. S. T.

Pressure wash bottle for volatile solvents. L. W. Charkey and D. V. Zander (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 857). L. S. T.

Chromatographic analysis in reverse. A. Lowman (*Science*, 1942, 96, 211—212).—Equal, measured amounts of the finely-powdered adsorbent are allowed to fall through a long column of the solution to be analysed. The adsorbent settling out contains the most strongly adsorbed substances at the bottom, and the least strongly adsorbed substances at the top. E. R. R.

Leakproof stopcock for regulation of take-off during distillation. M. S. Newman (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 902). L. S. T.

Tilting arc flow divider suitable for reflux ratio control. S. Palkin and S. A. Hall (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 901—902). L. S. T.

Separation of gas mixtures by thermal diffusion. B. Leaf and F. T. Wall (*J. Physical Chem.*, 1942, 46, 820—826).—Thermal diffusion data for the gas pairs N_2O-CO_2 , C_3H_8 -cyclopropane, $C_3H_8-CO_2$, $A-C_2H_6$, and CO_2 -cyclopropane are applied to equations based on the kinetic theory of non-uniform gases and on the theory of the thermal diffusion column. There is fair agreement, except for $A-C_2H_6$, between observed and calc. thermal diffusion coeffs. C. R. H.

Simple large-capacity extraction apparatus. E. Smallwood (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 903). L. S. T.

Surface replicas for microscopic observation. V. J. Schaefer (*Physical Rev.*, 1942, [ii], 62, 495—496; cf. A., 1942, I, 378).—Three methods, not involving immersion in H_2O , are described for the removal of the replicas from metallographic specimens which might form corrosion products with H_2O . N. M. B.

Properties of organic circulating materials for diffusion pumps in technical operation and a new form of oil diffusion pump. R. Jaekel (*Z. tech. Physik*, 1942, 23, 177—186).—For a given liquid the final vac. observed depends markedly on the method of measurement, even when the same type of apparatus is employed; Knudsen's abs. manometer is preferred. The effects of the working conditions and the oxidisability and thermolability of the oil are considered. Hickman's pump, in which self-purification of the oil takes place, is improved. A. A. E.

Glass safety valve for water vacuum-pump circuit.—See B., 1943, I, 87.

High-vacuum technique. G. Burrows (*J. Sci. Instr.*, 1943, 20, 21—28).—A review relating to pumps, vac. pipe lines, detachable joints and jointing media, vac. gauges and indicators, leaks, and surface treatment. A. A. E.

Transparent phase rule model. L. S. Ts'ai (*J. Chem. Educ.*, 1942, 19, 2). L. S. T.

Optical linear dynamometer, a universal instrument for the thermodynamic analysis of highly elastic changes of state. E. Wöhlisch (*Kolloid-Z.*, 1942, 100, 151—153).—The instrument described (details not given) combines a device for measuring the temp. coeff. of linear expansion at const. tension with one for measuring the temp. coeff. of tension at const. length. F. L. U.

Laboratory bellows pump [delivering 5—2500 c.c. at ~1 atm.]. B. B. Corson and W. J. Cervený (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 899—900). L. S. T.

Apparatus for small-scale catalytic hydrogenation. C. R. Noller and M. R. Barusch (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 907—908). L. S. T.

Examination of spectrographic plates taken in forensic work.—See A., 1943, III, 296.

Nomogram for the law of direction-cosines. S. I. Tomkeieff (*Min. Mag.*, 1942, 26, 272—273).—A simple nomogram for the equation $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$, for use as a check in optical and crystallographic measurements and calculations, is given. L. J. S.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Demonstration of an induced, or coupled, reaction. J. B. Sumner (*J. Chem. Educ.*, 1942, 19, 70).—Directions for demonstrating the coupled oxidation of carotene, which occurs when a trace of unsaturated fat, soap, or free fatty acid is peroxidised by lipoxidase, are given. L. S. T.

Measurement of surface tension. Laboratory experiment. T. H. Hazlehurst (*J. Chem. Educ.*, 1942, 19, 61—65). L. S. T.

Unimolecular film demonstrations. A. L. Kuehner (*J. Chem. Educ.*, 1942, 19, 27—28). L. S. T.

Mercury vapour made visible. H. C. Froelich (*J. Chem. Educ.*, 1942, 19, 314).—Ultra-violet light will reveal dark clouds arising at room temp. from a drop of Hg covered by a thin layer of a fluorescent powder. L. S. T.

Christopher Glaser. C. de Milt (*J. Chem. Educ.*, 1942, 19, 53—60). L. S. T.

Liebig and proteins. H. B. Vickery (*J. Chem. Educ.*, 1942, 19, 73—79). L. S. T.

Joseph Priestley (1733—1804). A. Kent (*Chem. and Ind.*, 1943, 71—72).

Edwin Emery Slosson. D. Barton (*J. Chem. Educ.*, 1942, 19, 17—20). L. S. T.

John Maclean, Charles Macintosh, and an early chemical society in Glasgow. J. A. V. Butler (*J. Chem. Educ.*, 1942, 19, 43—44). L. S. T.

Johann Rudolf Glauber, 1604—70, his chemical and human philosophy. E. V. Armstrong and C. K. Deischer (*J. Chem. Educ.*, 1942, 19, 3—8). L. S. T.

Development of alchemy in Bohemia. G. Druce (*Chem. and Ind.*, 1943, 51—53).

XIII.—GEOCHEMISTRY.

Separation of electricity in clouds. J. A. Chalmers (*Phil. Mag.*, 1943, [vii], 34, 63—67; cf. Simpson and Scrase, *Proc. Roy. Soc.*, 1939, A, 161, 309).—Theory of rain formation suggests that sudden freezing of H_2O drops occurs from 0° down to -15° to -20° in thunderclouds, the temp. around which the supercooled drops and ice particles co-exist. Investigations show a separation of charge at about these temp., indicating an association of the two phenomena. It is suggested that a separation of charge might be expected on sudden freezing by a mechanism similar to that which accounts for the separation of charge on the breaking of a drop. N. M. B.

Content and determination of actinium and its products in mineral waters. V. I. Baranov and S. G. Zeitlin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 563—565).—Contents of Ac-X, Ac, Ra, and Th-X in two Caucasian spring waters and a ferruginous sediment from one of the springs are recorded, and discussed in relation to the mechanism of the removal of the radioelements from underlying deposits. Ra and Ac are conc. in the sediment. A. J. E. W.

Sounding in the Tanezrouft. N. Menchikoff (*Compt. rend.*, 1942, 214, 379—380).—A boring at Bidon 5 (Sahara) to a depth of 160 m. shows the presence of H_2O rich in Cl^- , SO_4^{2-} , Na^+ , and Ca^{2+} . The existence of these salts is attributed to penetration of the H_2O through a stratum of gypsum, but the presence of H_2O suggests that deeper borings might reach sandstone where a purer H_2O might be expected. J. W. S.

Fundamental parameter of salt discharge for a clear river bed. B. N. Fortsch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 278—281). W. R. A.

Mean geochemical data in relation to oceanic evolution. E. J. Conway (*Proc. Roy. Irish. Acad.*, 1942, 48, B, 119—159).—Mean compositions of sedimentary rocks and of ocean H_2O are tabulated, and a quant. relationship between oceanic substances and weathered rock is deduced. Geochemical relationships are shown by curves of river H_2O composition plotted against salinity. Geochemical data for Cl^- are discussed for river and surface waters, and equations relating the distance of an isochlor from the sea coast are developed. Data for the mean composition of rain H_2O , and mean losses of bases from rock in a weathering cycle, are discussed. The mean quantities of weathered rock carried by 10^6 parts of river H_2O and their distribution as sediment and dissolved material are calc. A discussion of the geochemical data for SO_4^{2-} indicates that the main source of SO_4^{2-} in river H_2O is from a diffusion of volatile compounds from the shallow seas on the continental shelves. L. S. T.

Sedimentary origin of cone-in-cone structure. A. Bonte (*Compt. rend.*, 1942, 214, 498—500).—The primary cause of cone-in-cone structure is the decomp. of organisms which have been buried as a result of rapid sedimentation. The products of decomp. diffuse through channels in the enveloping sedimentary deposit and, as a result of chemical action, a hard concretion is formed around the fossil. C. R. H.

Theory of the formation of cone-in-cone structure. R. Gay (*Compt. rend.*, 1942, 214, 500—502).—A physico-chemical interpretation of Bonte's theory (cf. preceding abstract) is offered. The buried organism sets up around itself a series of concentric spherical diffusion regions of CO_3^{2-} which meet and react with parallel diffusion regions of Ca^{2+} . Pptn. of $CaCO_3$ takes place in a conic form with the cone pointed to the org. centre and open towards the side of increasing $[Ca^{2+}]$. The colloidal nature of the sedimentary deposit renders the $CaCO_3$ pptn. periodic, the resulting cone-in-cone structure having some analogy with Liesegang rings. C. R. H.

Meteors. T. E. Sterne (*Astrophys. J.*, 1942, 95, 437—440).—Rayleigh's and Taylor and Macoll's treatments of shock waves are used to estimate the temp. ($1.5\text{--}2 \times 10^6$ °) in a meteor moving at 60 km. per sec. through air initially at 180°K , and in the air (7×10^4 °) after subsequent expansion. The actual temp. are lower in each case because of ionisation and dissociation. E. R. R.

Age of the earth according to radioactivity data. E. K. Gerling (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 34, 259—261).—Previous calculations of the age of the earth from the relative abundance of U, Th, and Pb are probably in error owing to the assumption that all Pb is of radioactive origin. The observed isotope ratio for Pb is not in accord with this view. By assuming the galena from Ivigtut, Greenland, which is of relatively low ^{206}Pb , ^{207}Pb , and ^{208}Pb content, to be almost entirely of non-radioactive origin the admixtures of the various isotopes from radioactive sources in other sources of Pb are calc. From these data the average age of the Pb samples is calc. to be 130×10^6 years and the age of the earth $3\text{--}4 \times 10^9$ years. J. W. S.

Distribution of helium and radioactivity in rocks. IV. Helium age investigations of diabase and granodiorites from Yellowknife, N.-W. Territories, Canada. N. B. Keevil, A. W. Jolliffe, and E. S. Larsen (*Amer. J. Sci.*, 1942, 240, 831—846).—He indices of a diabase and its constituent minerals are generally $>$ those for the granodiorites that are cut by the diabase. For purposes of correlation the results are untrustworthy. Concentrates containing 75% of magnetite from diabase specimens gave abnormally high results due, probably, to magmatic He trapped during crystallisation, or to deuteric solutions that may have introduced the ilmenite and leucoxene. Pyroxene and olivine were less contaminated by He. Mafic minerals are, in general, more radioactive than felsic minerals. L. S. T.

Radioactivity and helium content of beryllium, boron, and lithium minerals of the U.S.S.R. V. G. Chlopin and S. A. Abidov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 637—640).—The amount of He in cu. mm. per g. of mineral has been determined for 25 Be, 10 B, and 3 Li minerals and also the amounts of Ra and Th present in some Be and B minerals. The amount of He present in the minerals does not depend on the radioactivity of the mineral, the amount of Be, B, or Li, or on the age of the mineral. Tourmalines, spodumenes, and zinnwaldite contain a measurable quantity of He. The most probable explanation of the high He content of these minerals appears to be that, during crystallisation, the minerals captured quantities of relatively short-lived radioactive elements or that He dissolved in the magma was selectively occluded. W. R. A.

Nitre formation in deserts. S. V. Odintzova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 578—580).—The nature of nitrate deposits in cavities and saline soils in the West Pamir mountains is discussed. The deposits are attributed to N fixation by algæ; blue-green algæ can be grown on Knop and Geitler's medium seeded with rock specimens from the region, and *Gloeocapsa minor* is identified in the growths. The ability of *G. minor* to fix N is confirmed by N determinations before and after cultivation on Bortels' medium. A. J. E. W.

New fluorine mineral occurring in the sublimates of the Klyuchevsky volcano. S. I. Naboko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 140—143).—The mineral, analysis = $(\text{Na}, \text{K})_5(\text{Ca}, \text{Mg})_{12}\text{Al}_{14}\text{F}_{47} \cdot 22\text{H}_2\text{O}$, forms a yellow crust on the lava blocks. Spectroscopic amounts of Be, Cu, Co, V, Cr, Zr, Ga, Ba, and Sr are present. The mineral is decomposed by conc. HCl; it is isotropic, with $n = 1.383$. The heating curve shows endothermal terraces at 170° , 710° , and 810° , and an exothermal terrace at 880° . L. S. T.

Chemical composition of the Lovozero loparite, and a method for its analysis. V. S. Bikova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 136—139).—Chemical analyses of loparites from malignite, luyavrite, and urtite of genetically-different horizons are recorded. L. S. T.

Deposits of metasomatic contact reaction. D. S. Korjinski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 133—135).—Petrological. The composition-paragenesis diagram for metasomatic rocks of the phlogopite deposits of the South Near-Baikal region is reproduced. L. S. T.

New mineral from the region of Lake Inder. G. S. Gorshkov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 254—256).—The new mineral, *inderborite*, has the formula $\text{CaO} \cdot \text{MgO} \cdot 3\text{B}_2\text{O}_3 \cdot 11\text{H}_2\text{O}$, and is analogous to hydroboracite. It is sparingly sol. in H_2O and cold acids, but dissolves readily in hot HCl. $d = 1.928\text{--}1.930$; hardness = 2.5. Optical and crystallographic properties are recorded. A. J. M.

New borate—metahydroboracite. N. J. Ikornikova and M. N. Godlevski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 257—258).—The mineral has the formula $\text{CaO} \cdot \text{MgO} \cdot 3\text{B}_2\text{O}_3 \cdot 11\text{H}_2\text{O}$; hardness 3.5, $d = 2.00$. (Cf. preceding abstract.) A. J. M.

Bentonite clays of Changhyr-Tash. S. M. Jusupova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 259—261).—The composition of bentonite clays has been investigated by the X-ray method. The

swelling of the clays in H_2O , EtOH, and kerosene has been studied. A. J. M.

Absolute geological age of the granites of the Podnebesny pluton in the Kuznetsk Alatau. V. K. Monitsch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 262—265).—Radiological investigation gives $240\text{--}250 \times 10^6$ years for the age of these granites. A. J. M.

Relationship between $\text{K}[\text{AlSiO}_4]$ (low sphalerite), $\text{Ba}[\text{Al}_2\text{O}_4]$, $\text{K}[\text{LiSO}_4]$, $\text{Na}[\text{AlSiO}_4]$ (nepheline), and $[\text{Si}_2\text{O}_4]$ (β -tridymite). W. Nowacki (*Naturwiss.*, 1942, 30, 471—472).—The lattice structures are compared. F. J. G.

Goyazite in the carboniferous limestones of the Donetz basin. N. V. Logvinenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 267—268).—Goyazite belongs to the aluminophosphate group ($2\text{SrO} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{P}_2\text{O}_5 \cdot 7\text{H}_2\text{O}$) and occurs in regular rhombohedral crystals with barite and secondary quartz in carboniferous rocks in the N.E. part of the Donetz basin to $\sim 10\text{--}13\%$. It is colourless, optically uniaxial, positive, birefringence low. It occurs in organogenous limestones and its paragenesis with secondary quartz shows that its formation is connected with hydrothermal processes. W. R. A.

Dolomite flour in the rocks of the Middle Cambrian of the Lena-Baikal watershed. N. V. Frolova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 413—415).—The occurrence of beds and lenses of dolomite flour is described. The origin of the flour by the preferential dissolution, by dil. acid, of calcite from dolomitic limestone is discussed. L. S. T.

Microcrystalline dolomites, their origin and pseudomorphoses of anhydrite and gypsum after dolomite rhombohedra in the lower Permian deposits of Tataria. L. M. Miropolski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 572—574).—The genesis of the deposits is discussed, and analyses of nine bore-hole specimens from different depths are recorded and calc. to % of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, CaSO_4 , CaCO_3 , and MgCO_3 . A. J. E. W.

Essential features of the petrology of the intrusive complex in the neighbourhood of the Yatyrgvarta mountain in the Northern Caucasus. V. A. Zatokovenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 651—653).—Geological and petrographic study of the intrusive complex indicate that the intrusion of magma occurred successively from gabbro through intermediate types to granitoids and that all the rocks of the complex belong to the same magmatic cycle. W. R. A.

Complex paragenetic diagram of the Dashkesan [cobalt] deposit. M. A. Karasik (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 401—405).—The diagram shows the processes of mineral formation and the accompanying tectonic movements, magmatic and postmagmatic processes, and the metamorphism of enclosing rocks and metasomatic phenomena. A geochemical table of elements of the Dashkesan intrusive complex is also given. L. S. T.

Free gold in the basic rocks of the district of Kaya (Upper Ivory Coast). L. Baud (*Compt. rend.*, 1942, 214, 380—382).—Of 87 samples of basic rock from this district examined, 58 contained 0.5—32.75 g. of free Au per ton. The neighbouring strata of granite contain much less Au and it is inferred that the Au originates from the basic magma. J. W. S.

Dendritic structure of crystallites of native gold. A. I. Fastalovitsch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 430—431).—In many Au particles and nuggets the crystallites composing them have a dendritic structure, which is described. The dendritic structure is revealed by electrolytic etching of the polished surface of a nugget by 20% aq. KCN containing 1% of NaOH. Dendritic growth of Au crystals render the conditions of formation of ore deposits is widespread. L. S. T.

Morphology and structure of "new" gold. N. V. Petrovskaja (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 427—429).—Au re-deposited in a placer occurs frequently in Au placers of the Aldan, Lena, and Djalinda-Urkan regions, affecting the size, shape, and composition of the placer Au. The morphology of this "new" Au is described. L. S. T.

Sulvanite from the Lebedinoye gold ore deposit (Aldan). N. V. Petrovskaja (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 424—426).—Aldan sulvanite (I) contains V 3.60, As 7.16, Cu 49.40, S 31.66, SiO_2 not determined, total 94.30%, and spectroscopic amounts of Pb, Bi, Sb, and Ag; a is 5.37 Å. Aldan (I) is a variety representing an isomorphous mixture of sulvanite and a green modification of enargite. L. S. T.

Zeolites of the Mama-Vitim mica-bearing region. M. N. Schkabara (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 420—423).—A chemical analysis [E. A. Sturm] of chabazite (I) is recorded is discussed. The crystallography of (I), heulandite, and epidemine is described. The zeolites of this region belong to hydrothermal segregations which form the subsequent stage of the pegmatite process. L. S. T.

Clarke of mercury in the earth's crust. A. A. Saukov and M. C. Aidinjan (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 358—360).—

From analytical data on 46 Hg-containing rocks from different sources the clark of Hg in the earth's crust is derived as $7.7 \times 10^{-6}\%$.
W. R. A.

Types of cinnabar crystals from High Ratcha and Abkhazia (Great Caucasus). E. K. Vezirischvili (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 416—419).—Results of goniometric measurements of crystals from Akhei, Boko, and Talakhiani are recorded; the last two form an independent type—the Boko type.
L. S. T.

Chemical composition of leucoxene in Cainozoic bauxite from Boolarra, Victoria. A. B. Edwards (*Min. Mag.*, 1942, 26, 273—274).—Yellow grains pseudomorphous after ilmenite are abundant in some of the bauxites, which are derived mainly from olivine-basalt. In this highly aluminous matrix it seemed that the mineral might be little-known Al titanate, xanthitane. Analysis, however, gave TiO_2 86.6, $\text{Fe}_2\text{O}_3 + \text{FeO}$ 3.6, SiO_2 1.2, Al_2O_3 0.5, $\text{H}_2\text{O} + 8.0\%$, indicating leucoxene, for which the formula is given as $\text{TiO}_2 \cdot n\text{H}_2\text{O}$.
L. J. S.

Datolite and other minerals in a contact-altered limestone at Chapel quarry, near Kirkcaldy, Fife. J. Phemister and A. G. MacGregor (*Min. Mag.*, 1942, 26, 275—282).—Limestone of Carboniferous age (SiO_2 21.72, TiO_2 0.40, Al_2O_3 4.26, Fe_2O_3 1.00, MnO 0.09, MgO 1.90, CaO 38.82, Na_2O 1.82, K_2O 0.25, $\text{H}_2\text{O} + \text{n.d.}$, H_2O —0.41, P_2O_5 0.08, CO_2 26.68, B_2O_3 2.00, FeS_2 0.21, total 99.64%) in contact with a quartz-dolerite sill shows a development of microscopic grains of garnet, datolite, apophyllite, pectolite, and steatite, some of which replace fossils.
L. J. S.

Comparative migration capacity of radium and meso-thorium I. I. E. Starik, N. M. Segel, and V. V. Vereschtschagin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 252—253).—Comparative leaching of Ra and meso-Th I from selected specimens of chlopinite over 8 years gives a ratio of ~ 1 .
W. R. A.

Ferrithorite in North Kirghizia. I. E. Starik, L. L. Kravtschenko, and O. S. Melikova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 254—255).—The discovery of ferrithorite (I) in N. Kirghizia and provisional analytical data are reported. (I) has hardness 4.5, fracture conchoidal, lustre pitch-dull, streak brown, xenomorphic, habit columnar. It is confined to the greisenised portions of the aplitic facies of Variscian granites. It is rarely pure and usually has inclusions of quartz, micas, and fluorite. All the SiO_2 is combined with Th and Fe is assumed to be present as a hydroxide.
W. R. A.

"Farinaceous" scheelite from the sub-Polar Urals. V. Vakar (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 265—266).—The occurrence of a scheelite in the sub-Polar Urals is described. It appears to result from frost weathering.
W. R. A.

Essential geological features of the intrusive complex in the neighbourhood of the Yatyrgvarta mountain in N. Caucasus. V. A. Zatokovenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 269—271).
W. R. A.

Possible age of allanite from Whiteface mountain, Essex Co., N.Y. J. P. Marble (*Amer. J. Sci.*, 1943, 241, 32—42).—Age determinations from the ratio $\text{Pb}/(\text{U} + 0.36\text{Th})$ give a val. of 12×10^8 years for allanite (I) occurring in anorthosite pegmatite near the summit of this mountain. Field investigations indicate that the pegmatite is pre-Cambrian and post-Grenville. Similar determinations for (I) from Cook Shaft, Mineville, N.Y., gave inconclusive results. Chemical analyses of both samples of (I) are recorded.
L. S. T.

Occurrence of mineralisation in Caledonian deposits. C. P. Guimarães (*Ann. Acad. Brasil. Sci.*, 1942, 14, 207—223).—Brazilian (Cantinho) deposits of willemite have been produced by hydrothermal action on Zn blende.
F. R. G.

Constituents of surface of formations. B. Brajnikov (*Compt. rend.*, 1942, 214, 374—377).—The factors which determine the stability of surface rocks are classified as sp. (chemical composition, cryst. or colloidal state and its degree of ageing, dimensions and form of the particles, and the electrostatic charge of the rock particles) or due to the medium (composition, pH val., and temp., and the presence or otherwise of organisms). The relative effects of these properties are discussed.
J. W. S.

Granitisation of hornfelsed sediments in the Newry granodiorite of Goraghtwood Quarry, Co. Armagh. D. L. Reynolds (*Proc. Roy. Irish Acad.*, 1943, 48, B, 231—267).—Petrological. Geochemical migrations occurring in the granitisation are summarised and represented diagrammatically. Numerous chemical analyses are recorded.
L. S. T.

Lueneburgite from the Stebnik potassium salt deposit. M. N. Godlevski and A. A. Ivanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 351—353).—Preliminary analytical data are given and discussed.
W. R. A.

New sulphates from the Blyava sulphate deposit (South Urals). T. N. Schadlun and J. S. Nesterova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 354—357).—The presence of sosmolnskite, roemerite, and potash alum in the Blyava deposit has been established and what was previously thought to be barite has been shown to be anglesite.
W. R. A.

Newly-discovered minerals in the pegmatites of Adun-Cholon (Transbaikalia). E. I. Nefedov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 361—364).—The following additional minerals have been found in the pegmatites of Adun-Cholon: bismuth, bismuthine, cassiterite, zircon, rutile, brookite, stuverite, psilomelane-wad, opal, calcite, yttrorparisite (a new mineral), scheelite, apatite, kaolinite, chlorite, phlogopite, and orthite.
W. R. A.

Relationships of the higher arsenides of cobalt, nickel, and iron, occurring in nature. R. J. Holmes (*Science*, 1942, 96, 90—92).—Minerals have been examined microscopically and by X-rays, and in some cases synthesised. The isometric diarsenides, RAs_2 (smaltite, chloanthite, and arsenoferrite), are discredited, since they have the same crystal structure as, and are considered identical with, the triarsenides (skutterudites). A revised classification includes safflorite $[(\text{Co}, \text{Fe})\text{As}_2]$, rammelsbergite (NiAs_2) , pararammelsbergite (NiAs_2) , and löllingite (FeAs_2) as orthorhombic arsenides, and skutterudite (CoAs_3) , Ni-skutterudite $[(\text{Co}, \text{Ni})\text{As}_3]$, and Fe-skutterudite $[(\text{Fe}, \text{Co})\text{As}_3]$ as isometric triarsenides.
E. R. R.

Dolomitisation in the eastern massif of the Ishimbaevo oil region. G. I. Teodorovitch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 34, 199—201).—The deposits of the central shallow bay of this massif are characterised by an alternation of anhydrite-bearing dolomites, spotted anhydrite-dolomitic rocks, dolomitic limestones containing anhydrite, and occasionally pure limestones. The process of dolomitisation suggested by a petrographic examination of core samples of these deposits is discussed.
L. S. T.

Goethite and lepidocrocite. M. A. Peacock (*Trans. Roy. Soc. Canada*, 1942, [iii], 36, IV, 107—118).—Goethite (I), $\alpha\text{-FeO}\cdot\text{OH}$, and lepidocrocite (II), $\gamma\text{-FeO}\cdot\text{OH}$, are the only hydrates of Fe oxide entitled to rank as mineral species. (I) from Steeprock Lake, Ontario, has a_0 4.587, b_0 9.937, c_0 3.015 Å.; space-group $D_{2h}^{16} - Pbnm$; $\rho_{\text{calc.}}$ 4.264, $\rho_{\text{obs.}}$ 4.264 and 4.266. (II) from Eiserfeld, Siegen, Westphalia, has a_0 3.86, b_0 12.50, and c_0 3.06 Å.; space-group $D_{2h}^{17} - Amam$; $\rho_{\text{calc.}}$ 3.97, $\rho_{\text{obs.}}$ 3.854. Morphological, form, and X-ray data are recorded.
L. S. T.

Paragenetic groups of minerals in the principal types of soils. I. D. Sedletzki (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 435—438).—The mineralogical composition of thin fractions $< 0.2 \mu$. of different types of soil formed on country rocks of the Soviet Union is tabulated and discussed.
L. S. T.

Röntgen-mineralogical study of the loess soils in the vicinity of Tashkent. S. M. Jesupova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 575—577).—The particle-size distribution for soils from different depths is studied, and the composition [including montmorillonite (I), kaolinite (II), quartz, muscovite-sericite, and halloysite] of fractions of particle-size $\geq 2 \mu$. is determined qualitatively from X-radiograms. Non-settling loess contains much (I), whereas in settling loess (II) predominates.
A. J. E. W.

Modern concepts of the physical constitution of coal. G. H. Cady (*J. Geol.*, 1942, 50, 337—356).—A review.
L. S. T.

Optical dispersion for coals. C. G. Cannon and W. H. George (*Nature*, 1943, 151, 225).—Curves are given for isotropic and anisotropic coals. It appears that the refracting material varies but little with the rank of the coal. The results for the latter would be consistent with a large-scale structure in which anisotropic units occur with preferred orientation.
A. A. E.

Refractive index of coals. C. G. Cannon and W. H. George (*Nature*, 1943, 151, 53—54).—Vals. of n parallel and perpendicular to the bedding plane of the coals are tabulated for λ 7000 Å. The latter increase with geological age to a const. max. of ~ 1.9 for anthracitic coals; the former first increase with "rank" and then decrease. The development of optical anisotropy coincides with the disappearance of coking properties.
A. A. E.

Vanadium, nickel, and copper in petroleum of the Urals and Volga region. L. A. Guliaeva, E. S. Itkina, and I. I. Romm (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 406—409).—Data showing the V, Ni, and Cu content in the ash of oils from the Second Baku are recorded and discussed in relation to those for oils from other districts. $\text{V}_2\text{O}_5 + \text{NiO} + \text{CuO}$ constitute $> 50\%$ of the ash, and are part of the org. substance of the oil. The contents are V $12.7 \times 10^{-3}\%$, Ni $4.3 \times 10^{-3}\%$, and Cu $2.48 \times 10^{-4}\%$. V and Ni, but not Cu, are most intimately connected with the S and asphaltene contents.
L. S. T.

Surface energy relationships in petroleum reservoirs. H. K. Livingston (*Amer. Inst. Min. Met. Eng. Tech. Publ.* 1526, 1942, 6 pp.).—Data for surface and interfacial tensions, spreading pressures, and contact angles for H_2O , C_7H_{16} , and SiO_2 are presented, and their application to the evaluation of capillary rise (r) and displacement pressure (p) in oil fields is discussed. r and p and rate of fluid flow are affected by the presence of certain surface-active substances, e.g., org. acids, N and S compounds, that may exist naturally or may have been added in the course of oil production.
T. C. G. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

MAY, 1943.

I.—SUB-ATOMICS.

Arc spectrum of bismuth, Bi I. S. Mrozowski (*Physical Rev.*, 1942, [ii], 62, 526—533).—The light-source was a heated quartz tube containing Bi and a few mm. of He and excited by a 4-m. oscillator. The intense arc spectrum showed all known lines and many new lines. With a high-quality 30-ft. grating photographs showing in the third order a very high resolution of $\sim 400,000$ were obtained. Hyperfine structure measurements for 55 lines, separations, and term vals. are tabulated and discussed, and available data are corr. and extended. N. M. B.

Spectral structure and ionisation potential of neutral gadolinium. H. N. Russell (*Astrophys. J.*, 1942, 96, 11—14).—The anticipated terms, $^{11}P^{11}D^{11}F$ (combining with a higher $^{11}D^0$) and slightly higher $^9D^0$ and $^9S^0$ terms are identified. The first ionisation potential is 6.16 v. $4f^7 6s^5 d^{10} D^0$ is confirmed as the lowest configuration of Gd II. $4f^7 6s^2 ^8S^0$ is probably 0.5 v. higher. E. R. R.

Configurations II's. G. Racah (*Physical Rev.*, 1942, [ii], 62, 523—525; cf. A., 1942, I, 221).—The spectra of the configurations are calc. by Dirac's vector model, and are compared with experimental data for Sc I, Y I, and Cu I. N. M. B.

Extension of the prismatic solar spectrum from 14μ . to 24μ ., through a new atmospheric window in the infra-red. A. Adel (*Astrophys. J.*, 1942, 96, 239—241).—Three records, obtained by means of a KBr prism and a vac. thermopile and periodic radiometer, are given. Transmission through the window depends on H_2O vapour. E. R. R.

Rowland intensity scale. F. E. Roach and J. G. Phillips (*Astrophys. J.*, 1942, 96, 71—74).—Intensity data for solar spectrum lines at 3530—3915 Å. are used in a statistical examination of the Rowland intensity scale. E. R. R.

Microphotometry of solar lines, $\lambda\lambda$ 3530—3915 Å. J. G. Phillips (*Astrophys. J.*, 1942, 96, 61—70).—Measurements (made from 7 spectrograms obtained with the 75-ft. spectrograph and the 150-ft. tower telescope) of equiv. width, degree of blending, and central intensity with respect to both the local and the true backgrounds for 1135 Fraunhofer lines are tabulated. E. R. R.

Influence of fluorescence on the central intensities of the solar D-lines. R. R. Dempster (*Astrophys. J.*, 1942, 96, 295—305).—Transition probabilities for the Na D-lines are calc. An equation of transfer is derived and applied to these lines. Reasons for the discrepancy between calc. and observed results are discussed. E. R. R.

Abundance of neutral iron atoms in the sun. F. E. Roach and J. G. Phillips (*Astrophys. J.*, 1942, 96, 75—77).— $(4.0 \pm 0.25) \times 10^{18}$ and $(5.1 \pm 0.35) \times 10^{18}$ atoms of Fe I over 1 sq. cm. of the solar photosphere are the vals. obtained by two independent calculations. E. R. R.

Typical stellar spectra with high dispersion. II. Spectrum of γ -Cygni. F. E. Roach (*Astrophys. J.*, 1942, 96, 272—291).— $\lambda\lambda$, intensities, and identifications of 664 lines in the Coudé spectrograms of γ -Cygni from 3977.76 to 4404.76 Å. are recorded. These include lines of Ce II, Pr II, Nd II, Sm II, Eu II, Gd II, Tb II, and Dy II. E. R. R.

Spectrographic observations of peculiar stars. IV. P. Swings and O. Struve (*Astrophys. J.*, 1942, 96, 254—271; cf. A., 1942, I, 310).—AX Persei showed intense lines of [Fe v] and [Fe vi], and other changes, in Jan. and Feb., 1942. RW Hydrae showed no fluorescence excitation in O III, but strong He I singlets ($2p^1 P^0 - nd^1 D$). Z Andromedæ has returned to a stage similar to that of Aug., 1940. T Coronæ Borealis showed bright lines of Fe II, but no [Ne v]. Fluorescence excitation is discussed in relation to the problem of selectivities among emission lines of peculiar stars. E. R. R.

Discovery and observation of stars of class Be. III. P. W. Merrill, (Miss) C. G. Burwell, and W. C. Miller (*Astrophys. J.*, 1942, 96, 15—19).—86 bright-line stars discovered by objective-prism photographs of the H α line, and 41 other stars showing this line, are listed. E. R. R.

Singly-ionised calcium emission in 56 Pegasi. P. C. Keenan and J. L. Greenstein (*Astrophys. J.*, 1942, 96, 309—310).—Very strong H- and K-lines of Ca II are reported. The intensity ($R \sim 0.8$) is

probably variable and a weak and narrow reversal of the K-line may occur. E. R. R.

Intensities of metallic lines in the ultra-violet spectrum of α^2 Canum Venaticorum. W. S. Tai (*Astrophys. J.*, 1942, 96, 218—223).—Struve's estimated line intensities are used to confirm the conclusion that Ti II belongs to class A, while Cr II and Fe II belong to class B. The intensities of lines of several elements are compared with those of α -Lyrae. E. R. R.

Coefficient of limb-darkening for YZ(21) Cassiopeiae in red light. G. E. Kron (*Astrophys. J.*, 1942, 96, 173—187).—A method of observing the light curve sufficiently accurately to determine darkening coeffs., using a red-sensitive Cs cell, is described. The darkening coeff. of the A3 component is 0.33, that of the F5 is 0.5 at a mean of 6700 Å. E. R. R.

Radiation pressure in the point-source stellar model. L. R. Henrich (*Astrophys. J.*, 1942, 96, 106—123). E. R. R.

Continuous emission in the spectra of planetary nebulae. T. Page (*Astrophys. J.*, 1942, 96, 78—100).—Continuous emission spectra are observed in 31 out of 58 nebulae. Intensity ratios have been measured, and intensities correlated with surface brightness and with excitation, which is peculiar in nebulae of low brightness. E. R. R.

Continuous emission in the spectra of gaseous nebulae. P. Swings and O. Struve (*Astrophys. J.*, 1942, 96, 310—311).—The visual continua in the spectra of Orion nebula, IC418, and IC2165, photographed through a narrow slit, are not produced by the blending of at. emission lines. With a wide slit, strong He I lines just beyond the Balmer limit may vitiate intensity distribution measurements in the continua. E. R. R.

Crab nebula. W. Baade (*Astrophys. J.*, 1942, 96, 188—198).—The nebulosity consists of an outer system of filaments and an inner mass of amorphous structure. In the region of H α , the former give rise to the line spectrum, the latter to the continuum, which contributes $>80\%$ of the light and is probably an emission spectrum. The south preceding star is probably the exciting star. E. R. R.

Crab nebula. R. Minkowski (*Astrophys. J.*, 1942, 96, 199—213).—The filaments on the outside of the nebula produce emission lines of H (faint), He I, He II, [N II], [O I], [O II], [O III], and [S II]. The spectrum of the main diffuse nebulosity is continuous, except at the Balmer limit, and contains practically all the energy emitted by the nebula; the colour temp. is $\sim 8400^\circ$ K. at 4500 Å. and $\sim 6700^\circ$ K. at 6000 Å. The continuous spectrum is explained on the basis of free-free and free-bound transitions of electrons in the highly-ionised gas. The electron density is $\sim 10^3$ per c.c.; the electron temp. is $\sim 50,000^\circ$; the temp. of the central star is $\sim 500,000^\circ$. The high intensity of the [O II] lines in the filaments, compared with those in spectra of planetary nebulae, and the faintness of H lines indicate a high central star temp. and a low H abundance. The results support Chandrasekhar's theory of the supernova process. E. R. R.

Direct experimental determination of electron-affinity of chlorine. K. J. McCallum and J. E. Mayer (*J. Chem. Physics*, 1943, 11, 56—63).—The electron-affinity of Cl_2 has been determined by measuring the ratio of ions to electrons leaving a hot W surface in contact with a low pressure of gas containing Cl atoms. Cl_2 and $SnCl_4$ were used as carrier gases. The val. obtained, 85.84 ± 1.0 kg.-cal., agrees closely with that obtained by measurements on the dissociation of alkali halides, and the vals. calc. using theoretical lattice energies and the Born cycle. A. J. M.

Periodic deviation from the Schottky line. II. T. E. Phipps (*Physical Rev.*, 1942, [ii], 62, 554—555).—An equation (cf. A., 1939, I, 589) is corr. The error probably accounts for a disagreement with the results of Seifert (*ibid.*). A sharp redefinition of terms and a survey of experimental results is advocated. N. M. B.

Dynamics and scattering-power of Born's electron. E. Schrödinger (*Proc. Roy. Irish Acad.*, 1942, 48, A, 91—122; cf. *ibid.*, 1942, 47, A, 77).—Mathematical. A treatment by approximation methods to ascertain the physical requirements of the mathematical solution, on the postulate that a classical must precede a quantum mechanical understanding, is given. N. M. B.

Wave function for the negative hydrogen ion. R. E. Williamson (*Physical Rev.*, 1942, [ii], 62, 538—539).—A six-parameter wave function is derived and tested. N. M. B.

Polarisability of H^- . L. R. Henrich (*Physical Rev.*, 1942, [ii], 62, 545—547).—The val. computed from third- and from sixth-order Hylleraas-type wave functions is 11.58×10^{-24} and 14.63×10^{-24} c.g.s. unit, respectively. N. M. B.

Saturation characteristics for α -particles in purified gases. E. D. Klema and H. H. Barschall (*Physical Rev.*, 1943, [ii], 63, 18—23).—In order to investigate the purity necessary to obtain improved saturation characteristics, saturation curves were taken in N_2 , A, and an A- H_2 mixture. Even unpurified A and N_2 show saturation at very much smaller field strengths than air. On purification an appreciable lowering of the field necessary for saturation was observed. N. M. B.

Electric arcs in gases at high pressures. J. Basset (*Compt. rend.*, 1942, 214, 715—716).—With C electrodes of ~ 2 mm. diameter in N_2 or A at > 9000 kg. per sq. cm. pressure, arcs at 250—600 v. have been obtained. The crater diameter is ~ 1 mm. and the estimated temp. $\sim 5000^\circ$. C above the b.p. in the crater condenses in light graphite flakes. N. M. B.

At. wt. of lead from a second sample of pitchblende, Great Bear Lake, N.W.T., Canada. J. P. Marble (*J. Amer. Chem. Soc.*, 1942, 64, 3047).—The val. of 206.057 agrees well with that of the first sample, 206.054 (cf. A., 1934, 578). W. R. A.

Theory of successive radioactive transformation. W. F. Sedgwick (*Proc. Camb. Phil. Soc.*, 1943, 39, 68).—Corrections and a note on an alternative method (cf. A., 1942, I, 313). L. J. J.

High centrifugal fields and radioactive decay. S. Freed, A. H. Jaffey, and M. L. Schultz (*Physical Rev.*, 1943, [ii], 63, 12—17).—Each type of radioactive decay (except fission) was investigated, by Geiger-Müller tube counter and by ionisation chamber and amplifier, under the influence of centrifugal fields of $\sim 500,000g$. No definite effect was found, but in ^{80}Br there was some sign of systematic deviation from the accepted half-lives in a field of 632,000g. N. M. B.

Diffusion length of carbon neutrons in water. G. R. Gamertsfelder and M. Goldhaber (*Physical Rev.*, 1942, [ii], 62, 556—557).—A more direct method of measurement with a spherically symmetrical source of C neutrons is described. The val. found is 3 cm. $\pm 10\%$, compared with available vals. 2.5 cm. (cf. Feeny *et al.*, A., 1942, I, 286) and 2.22 cm. (cf. Manley *et al.*, *ibid.*, 223). N. M. B.

Effective cross-section of [atoms of] certain elements for thermal neutrons. F. G. Houtermans (*Z. Physik*, 1941, 118, 424—425).—Vals. obtained by the Fermi-Amaldi method for ^{55}Mn , $^{63}, ^{65}Cu$, ^{79}Br , ^{103}Rh , ^{108}Pd , $^{107}, ^{109}Ag$, ^{115}In , ^{127}I , ^{164}Dy , ^{181}Ta , ^{186}W , ^{197}Au , and ^{209}Bi are recorded. L. J. J.

Angular distribution of photo-neutrons (γ_R , Be). T. A. Goloborodko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 855—856).—Using the method previously described (A., 1941, I, 440), the angular distribution of faster photo-neutrons was determined with a larger amount of paraffin than usual surrounding the chamber, in order to absorb slower neutrons. With a sphere of paraffin of diameter 13 cm., $I_{90}/I_0 = 1.42$, whereas with a sphere of paraffin of diameter 6 cm., $I_{90}/I_0 = 1.05$. A. J. M.

Diffusion problems. W. Bothe (*Z. Physik*, 1941, 118, 401—408).—Mathematical. Rigid expressions are developed for diffusion equation, diffusion const., diffusion distance, angular distribution, and albedo. The expressions, applicable to neutrons, are more rigid than those of Fermi, but less general than those of Halpern, Lueneburg, and Clark (A., 1938, I, 112). L. J. J.

Diffusion from a point source. W. Bothe (*Z. Physik*, 1942, 119, 493—497).—An addition to a previous paper (cf. preceding abstract). A more exact expression for the density distribution in an infinite scattering and absorbing medium containing a point source is deduced. A. J. M.

Frequency of odd and even atomic nuclei. V. V. Tscherdintzev (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 22—23).—The application of the liquid drop theory of the at. nucleus leads to a formula which gives satisfactory results for the difference between the logs of the relative frequencies of odd and even nuclei. A. J. M.

Angular correlation of successive γ -rays. R. Beringer (*Physical Rev.*, 1943, [ii], 63, 23—28).—In an attempt to evaluate the predicted angular correlations of successive quanta, a study of the angular dependence of γ - γ coincidences for ^{24}Na , ^{38}Cl , and ^{82}Br showed that coincidence rates were approx. independent of the relative directions of the quanta, except as the counters approached each other closely, when there was an increase which is attributed to scattered quanta. N. M. B.

Scattering of protons by magnesium nuclei. G. A. Wrenshall (*Physical Rev.*, 1943, [ii], 63, 56—57).—An extension, obtained by further analyses, of results previously reported (cf. Wilkins, A.,

1941, I, 24, 441). There is evidence of a fifth group of scattered protons of estimated energy 5.3 Me.v. N. M. B.

Scattering of 14-mv. neutrons by protons. E. Amaldi, D. Boccia-relli, B. Ferretti, and G. C. Trabacchi (*Naturwiss.*, 1942, 30, 582—584).—The angular distribution of neutrons scattered by protons has been reinvestigated (cf. *Ric. Scient.*, 1941, 12, 830) with improved apparatus. Neutrons provided by the reactions $^2D + ^{11}B = ^{12}C + ^1_0n$ and $^2D + ^7Li = ^8Be + ^1_0n$ were used, those from B being more suitable than those from Li. Results are given for neutrons with energies 12.5, 13.3, and 14 mv. They agree with the anisotropy indicated by the theory of Bethe, but not with that of Rarita *et al.* (A., 1941, I, 317). A. J. M.

Secondary radiation from X-ray filters. I. Single metal filters. G. A. Wrenshall and H. J. Nichols (*Canad. J. Res.*, 1942, 20, A, 185—194).—An ionisation chamber method is used to determine the intensity (I_s) and character of secondary radiation emitted in a forward direction from Al, Cu, Sn, and Pb foils penetrated by X-rays (intensity I_p) from a W anticathode operating at 85—115 kv. I_s is max. for foils of mass 0.70, 0.04, 0.07, and < 0.02 g. per sq. cm., respectively. The secondary radiation consists of K fluorescence radiation from the filter and scattered primary rays. The effect of the geometrical disposition of the source, filter, and ionisation chamber on I_s/I_p is studied; the conclusions of Seemann (A., 1938, I, 160) are, in general, verified. A. J. E. W.

γ -Rays from ^{48}Sc . C. E. Mandeville (*Physical Rev.*, 1942, [ii], 62, 555—556).—In view of discordant available data, Compton recoils of the γ -rays from ^{48}Sc produced by $Ca +$ deuterons were investigated with a γ -ray spectrograph. The momentum distribution curves indicate a half-life of 44 ± 1.5 hr. The γ -rays are monochromatic. The spectral end-point corresponds with a γ -ray energy of 1.35 ± 0.03 Me.v. One probable mode of ^{48}Sc disintegration is the emission of a negative electron spectrum of max. energy 0.640 followed by a γ -ray of energy 1.35 ± 0.03 Me.v. An excitation level in the ^{48}Ti residual nucleus is established at 1.35 ± 0.03 Me.v. (cf. Walke, A., 1940, I, 141). N. M. B.

β -Ray spectrum of antimony (124). E. B. Hales and E. B. Jordan (*Physical Rev.*, 1942, [ii], 62, 553—554).—Measurements of the continuous (negative electron) spectrum of a source produced by deuteron bombardment of Sb were started > 70 days after bombardment. The curve shows that the spectrum consists of two components, the end-points corresponding with energies of 0.74 ± 0.03 and 2.45 ± 0.07 Me.v. The difference agrees with the known energy val. of the hard γ -ray of ^{124}Sb (cf. Mitchell, A., 1940, I, 338). The internal conversion lines correspond with two of the internally converted γ -rays emanating from the separated Te fraction. N. M. B.

β -Spectrum of radioactive tungsten. B. Dshelepov and A. Konstantinov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 853—854).—To decrease the background in a counter, a special arrangement of two counters is used. The apparatus can be used to examine sources which emit as few as 5 electrons per sec. in all directions from an area of 1.5 sq. cm. It has been used to investigate the β -spectrum of radioactive W prepared by irradiation of W powder with slow neutrons. A. J. M.

Enrichment of the artificial radioactive uranium isotope $^{239}_{92}U$ and its product $^{239}_{93}$ (element 93). K. Starke (*Naturwiss.*, 1942, 30, 577—582).—Methods of enrichment of $^{239}_{92}U$ are described. The separation of $^{239}_{92}U$ from remaining U, and from U-X and disintegration products, using complexes formed with benzoylacetone is described. The chemical properties of element 93 are discussed, and it is considered that a series of elements with properties similar to those of U commences with U in the same way as a series of elements begins with La. The general applications of the enrichment method are described. A. J. M.

Spin inversion processes and nuclear spectroscopy. G. Beck and J. L. R. Martins (*Physical Rev.*, 1942, [ii], 62, 554; cf. A., 1942, I, 255).—Mathematical. Spin inversion processes may occur, as in the case of 6Li , with considerable probability even if they are due to small forces. N. M. B.

Relation of cosmic radiation to geomagnetic and heliophysical activities. J. W. Broxon (*Physical Rev.*, 1942, [ii], 62, 508—522; cf. A., 1941, I, 289, 315). N. M. B.

Number of slow neutrons in cosmic radiation. A. P. Shdanov and A. S. Serdakov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 861—862).—Two thick-emulsion plates, one of them having been immersed in aq. $Na_2B_4O_7$, were left in a building with no α -, β -, or γ -ray or neutron sources for 20 days. After development the tracks with an air equiv. of ~ 1 cm. were counted. There were 10 times as many on the plate treated with $Na_2B_4O_7$ as on the untreated plate. This is probably due to fission of the ^{10}B nucleus, induced by slow neutrons of cosmic rays. The no. of these slow neutrons was thus calc. as 10 per hr. per sq. cm. A. J. M.

Theory of cosmic-ray showers. II. Fluctuation problem. W. T. Scott and G. E. Uhlenbeck (*Physical Rev.*, 1942, [ii], 62, 497—508; cf. A., 1940, I, 242).—Mathematical. The distribution in size of

cosmic-ray showers is completely determined when the average energy distribution of the particles is known. Previous vals. of the size fluctuation of showers are revised and extended. Simplified models are considered and ionisation is taken into account. Results are extended to the actual cosmic-ray problem. N. M. B.

Life period of the meson. J. Jniffs (*Naturwiss.*, 1942, 30, 584—585).—Investigation of the composition of cosmic radiation at different heights indicates the existence of mesons at sea level with a life period of $(2 \pm 1) \times 10^{-4}$ sec., but at greater heights, mesons exist with a much smaller life period. A. J. M.

Cloud-chamber track of a decaying mesotron. R. P. Shutt, S. De Benedetti, and T. H. Johnson (*Physical Rev.*, 1942, [ii], 62, 552—553; cf. A., 1942, I, 256).—Photographs are given of the disintegration of a mesotron of 40—400m. and estimated final energy $< 10^4$ e.v. into a lightly ionising particle (electron) of energy probably $> 3 \times 10^2$ e.v., which flies off at 85° with the direction of the primary mesotron track. The type of disintegration is that postulated to account for certain anomalies in the absorption of cosmic rays in the atm. The chamber pressure is 70 atm. in a mixture of A, Pr⁺OH, and H₂O vapour. The estimated probability of disintegration is 5×10^{-7} per cm. N. M. B.

Theory of the bi-meson. V. L. Ginzburg (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 857—860).—Wave equations are developed for the bi-meson, a particle having spin 0 in the lowest state, and 1 in the singly excited state. A. J. M.

Evolution of the main-sequence stars. M. Schönberg and S. Chandrasekhar (*Astrophys. J.*, 1942, 96, 161—172).—The decrease in H content in the central regions, due to the burning of H in the evolution of main-sequence stars, is calc. In this process the convective core shrinks in the very bright stars; in stars of low luminosity and in the later stages of evolution in bright stars, the convective core gives place to an isothermal core. The upper limit to the fraction of H which can be used is $\sim 10\%$; beyond this stage, evolution probably proceeds through non-equilibrium configurations. E. R. R.

Spin and radiation force. W. Wessel (*Naturwiss.*, 1942, 30, 606—607).—Theoretical. A. J. M.

Relativistic theory of excited spin states of the proton and neutron. V. L. Ginzburg (*Physical Rev.*, 1943, [ii], 63, 1—12).—Mathematical. The anomalous (theoretical) increase with energy of the cross-section for meson scattering by heavy particles must be explained by the neglect of the reaction of the proper field of the quasi-magnetic moment of the particle on the motion of this moment. The problem is treated by the introduction of the higher spin states. N. M. B.

II.—MOLECULAR STRUCTURE.

Asymmetric rotor. I. Calculation and symmetry classification of energy levels. G. W. King, R. M. Hainer, and P. C. Cross (*J. Chem. Physics*, 1943, 11, 27—42).—A table of energy level patterns for rigid asymmetric rotors is given, from which rotational energies of all mols. up to $J = 10$ may be evaluated. The symmetry classification of each level is determined and expressed in terms of the K vals. of the limiting prolate- and oblate-symmetric rotors. Energy calculations by perturbation methods can be carried out by the use of the transformation described. L. J. J.

Isotope shifts in some lines of nitrogen. J. R. Holmes (*Physical Rev.*, 1943, [ii], 63, 41—46).—Extensive experimental difficulties were overcome by mixing a trace of 70 at.-% ¹⁵N—30 at.-% ¹⁴N with He at a few mm. pressure in a quartz tube cooled with liquid air and having external electrodes for excitation by a 12-m. oscillator. The line spectrum, photographed with a Fabry-Perot interferometer, was so sharp as to allow the resolution of the two components due to ¹⁴N and ¹⁵N in 9 infra-red lines. The lines arising from ⁴P → ⁴P and ⁴S → ⁴P transitions showed a negative isotope shift of ~ 0.06 cm.⁻¹, and those from ²P → ²P a positive shift of ~ 0.07 cm.⁻¹. The variations in the isotope shifts within the ²P → ²P multiplets indicate some deviation from Russell-Saunders coupling. No hyperfine structure was observed. N. M. B.

Spectra of CH stars. P. C. Keenan (*Astrophys. J.*, 1942, 96, 101—105).—Bands of CH appear at high intensity in 5 high-velocity C stars ("CH stars"). The (0, 0) and (1, 1) bands of both the ²Δ—²Π and ²Σ—²Π systems have been identified in two of the hottest of these stars, and explain the suppression of most at. lines at 3883—4430 Å. Lines of H, Sr⁺, Ba⁺, and Ti⁺ are visible; low-excitation lines of neutral elements are greatly weakened. The line spectrum of these stars is peculiar. E. R. R.

Laboratory production of the 4050 Å. group occurring in cometary spectra; further evidence for the presence of CH₂ molecules in comets. G. Herzberg (*Astrophys. J.*, 1942, 96, 314—315).—The 4050 Å. group is produced by an interrupted, electrodeless discharge through CH₄, or, at very high streaming speeds, by an uninterrupted discharge. The spectrum is compared with that of Comet 1940c, and the group attributed to CH₂. CH₂ and CH₃ cannot be excluded. E. R. R.

Presence of potassium hydride lines in the spectrum of the solar disc. W. P. Bidelman (*Astrophys. J.*, 1942, 96, 157—158).—Coincidences between lines of the KH spectrum and those of the solar disc are of the same order as those to be expected by chance. E. R. R.

Spectrum of comet 1942a (Whipple). D. M. Popper and P. Swings (*Astrophys. J.*, 1942, 96, 156—157).—A very strong reflected solar spectrum and a weak mol. emission are reported. Bands of CN, NH, and OH, and the 4050 Å. group, are conspicuous. CH bands are absent. E. R. R.

Absorption spectra of double salts containing cobaltous chloride. M. L. Schultz and E. F. Lilek (*J. Amer. Chem. Soc.*, 1942, 64, 2748—2751).—Absorption spectra of crystals of Cs₂CoCl₄, Cs₂CoCl₆, and dipyrindinium and diquinolinium Co^{II} chlorides, when compared with that of CoCl₂ in conc. HCl, indicate the presence of the CoCl₄²⁻ ion in all these compounds. The spectra appear to originate in coupled electronic-vibrational transitions. W. R. A.

Absorption spectra of the vapours of uranium chlorides. I. M. Tolmatshev (*J. Phys. Chem. Russ.*, 1941, 15, 592—596).—Vapour of UCl₄ shows a continuous absorption, the frontier of which is at 3490, 3950, 4190, 4410, and 4540 Å. at 100°, 227°, 308°, 372°, and 445°, respectively. UCl₃ vapour shows two diffuse bands near 2680 and 3750 Å. and two continuous absorption regions; above 60° it also shows the absorption spectrum of Cl₂. J. J. B.

Effects of solvents on the absorption spectra of dyes. I. Polymethine dyes. S. E. Sheppard, P. T. Newsome, and H. R. Brigham. II. Dyes other than cyanines. S. E. Sheppard and P. T. Newsome (*J. Amer. Chem. Soc.*, 1942, 64, 2923—2937, 2937—2946).—I. The absorption spectrum of a merocyanine dye has been determined for the gaseous state in a vac. The displacement of the absorption bands in various solvents is referred to that in a vac. Certain compounds show a definite correlation of the displacement with n and the dielectric const. for non-polar solvents, and μ for polar solvents. Ionised cyanine dyes show no displacement by changes in μ , but in non-polar solvents changes in n and dielectric const. cause changes. Solvent effects in relation to the structures of the dyes and the exceptional behaviour of alkyl halides are discussed.

II. For dyes other than cyanines the above conclusions are supported. The sensitivity of the absorption spectra of dyes to solvent influence is related closely to the resonance system of the dye. The possibility of adducing information regarding the structure of the dyes and of the solvents by investigations of this kind is discussed. W. R. A.

Ultra-violet absorption spectra and structures of N-phenylpyrazolone derivatives.—See A., 1943, II, 105.

Spectrophotometric studies. I. Structural interpretation of the spectra of cyanide, pyridine, and carbon monoxide derivatives of cytochrome-c and haemoglobin. D. L. Drabkin (*J. Biol. Chem.*, 1943, 146, 605—617; cf. A., 1941, III, 831).—Absorption spectra of derivatives of ferro-proto-, -meso- (I), and -copro-porphyrin (II), haemoglobin, and ferrocytochrome-c (III) are studied. The max. of the α - and β -bands of the spectra of ferromeso- and ferrocoprohæmin derivatives are at almost identical $\lambda\lambda$, whilst the spectra of corresponding derivatives of ferroprotohæmin are shifted towards longer $\lambda\lambda$. The max. of the spectra of (III) and its derivatives are located at $\lambda\lambda$ characteristic of (I) and (II) compounds. The spectra of the derivatives of the ferrohæmins can be classified into three groups, characteristic of the cyanide, C₅H₅N, and carbonyl complexes, respectively. The nature of the group co-ordinating with the hæmin Fe determines the intensity and shape of the absorption pattern in the visible spectral region (α - and β -bands). The λ location of the max. is a function of the hæmins themselves. The shift of absorption towards longer $\lambda\lambda$ in the case of protohæmin and its derivatives is probably due to the double linking in the vinyl groups. It is concluded that natural cytochrome-c does not contain an unmodified protohæmin with free vinyl groups in its structure. A. T. P.

Fluorescence of phenylated anthracenes. Y. Hirshberg and L. Haskelberg (*Trans. Faraday Soc.*, 1943, 39, 45—48).—Fluorescence measurements with mono-, di-, and tetra-phenylanthracenes show that in every case phenylation increases the abs. intensity of fluorescence compared with that of anthracene. The most marked effects accompany substitution in the 9- and or 10-positions. Theoretically dihydroanthracene derivatives should be non-fluorescent, but marked fluorescence is observed in 1:4:5:8-tetraphenyldihydroanthracene. The fluorescence, however, corresponds exactly with that of the corresponding anthracene derivative and is probably due to the presence of traces of the latter, the high abs. intensities being attributed to its high dilution. F. L. U.

Mechanism of luminescence in phosphors. V. Antonov-Romanovskii (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 863—865).—The luminescence of KCl, activated by Tl, has been investigated for various conditions of excitation. The decay of the fully excited phosphor follows a bimol. law, and the mechanism of the luminescence is of a recombination type, rather than a metastable one. If the excitation is weak, the luminescence is unimol. and later

bimol. The unimol. nature of the initial stage is probably due to the fact that when the excitation is weak, the average distance of ejection of an electron from the phosphorescence centre is $<$ the mean distance between the centres, so that each electron recombines with its own centre. The bimol. law is followed when the electrons become well "mixed" by diffusion. This theory is supported by experiments with red light. The mechanism of phosphorescence proposed makes it possible to explain the decay curve both qualitatively and quantitatively. The electron diffusion const. has been calc. from the decay curve. A. J. M.

Minimum wall-thickness and optimum wall-thickness of luminescent glasses in illuminating tubes. H. Fischer and A. Schöntag (*Z. tech. Physik*, 1942, **23**, 194—196).—The effect of the thickness (S) of the luminescent material in the wall of a discharge tube on the light yield is examined. For max. efficiency with colourless luminescent glasses, S has a min. val. (S_m) which represents the penetration of the exciting radiation, and thus depends on the concn. of luminescent material in the glass. With coloured glasses max. efficiency requires an optimum S val. (S_o) which depends on the absorptive properties. Data for low-pressure Hg-vapour tubes of U glasses (UO_3 0.7—2.1%; S_o 0.7—0.12 mm.) are discussed. A. J. E. W.

Luminescence of luminol. II. Action of complex ferric compounds on the chemiluminescence of luminol. K. Weber, A. Režek, and V. Vouk (*Ber.*, 1942; **75**, [B], 1141—1153).—The brightness of the chemiluminescence of luminol (I) in the presence of $K_3Fe(CN)_6$ (II), salicylaldehyde-ethylenedi-imine $FeCl_3$ (III), chlorohæmin, methæmoglobin, ferritin (IV), and catalase (V) is frequently many hundred times $>$ that in the absence of catalysts, and diminishes with time according to the law of a unimol. reaction. During the course of the change the catalysts are irreversibly altered chemically whilst (I) and H_2O_2 enter partly but by no means completely into reaction. For the initial brightness of the chemiluminescence there is an optimal $[OH^-]$ which lies at pH ~ 12.6 , whereas the ability to fluoresce, dependent on the conversion of the carbonyl- into the enol form, is almost completely suppressed at pH ~ 9 . With (IV) as catalyst the total light energy emitted tends towards a const. val. independent of $[OH^-]$, whereas in presence of (III) there is little change of intensity with $[OH^-]$. With hæmin increase in $[OH^-]$ causes first an increase and then a decrease in intensity. (II) causes a decrease but hæmoglobin (VI) or (IV) an increase of intensity with increase in $[OH^-]$. With very small concns. of catalyst there is an increase in initial brightness with catalyst concn. which gradually becomes less pronounced; increases in larger catalyst concns. may diminish the luminescence. Particularly in the presence of (II) and (IV) the chemiluminescence reaction appears to be accompanied by another redox reaction which, without emission of light, leads to a permanent chemical alteration in the reaction mixture. The catalytic activity of hæmin-Fe in (VI) and particularly in (V) is very markedly enhanced by its union with the protein residue, but the change is not a decomp. of H_2O_2 since there is no functional relationship between brightness of luminescence and O_2 evolved, and the optimal pH vals. for the processes are different. (IV) has no catalase or peroxidase action and its effect on (I) is comparable with that of (II) and immeasurably smaller than that of (VI), or (V). The mechanism of the reactions is discussed. H. W.

Luminous characteristics of phosphorescent materials.—See B., 1943, I, 153.

Excitation of ultra-violet phosphorescence in alkali halide phosphors activated with thallium. M. L. Katz (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 178—180).—NaCl and KCl crystals activated with TlCl show phosphorescence in both their ultra-violet absorption bands (1990 and 2540 Å. for NaCl, 1960 and 2480 Å. for KCl). The phosphorescence quantum yield is 230—250 times as great in the short- λ as in the long- λ band. The $\lambda\lambda$ of phosphorescence and absorption max. in the latter agree. Phosphorescence intensity increases with $[Ti]$ up to 15×10^{-2} mol.-% TlCl. L. J. J.

Phosphorescence of adsorbed tryptaflavine and its quenching by oxygen. J. Franck and P. Pringsheim (*J. Chem. Physics*, 1943, **11**, 21—27).—The green phosphorescence of tryptaflavine (I) adsorbed on SiO_2 gel is half-quenched by O_2 at 5×10^{-6} mm. Further increase in p_{O_2} increases quenching much more slowly, at a rate which agrees with the quenching of the green fluorescence by O_2 . The phosphorescence is ascribed to two metastable tautomeric forms of (I) formed on irradiation, one rapidly oxidised by O_2 , the other insensitive. Quenching at higher p_{O_2} is due to oxidation of the primary excited state. The apparent quenching effect of H_2O and NH_3 is due to O_2 displaced from the SiO_2 gel. L. J. J.

The ratio rule. H. D. Noether (*J. Chem. Physics*, 1943, **11**, 97—99).—A rule for obtaining the fundamental frequencies of isotopic mols. is given. Taking CD_3Cl for example, the fundamental frequencies can be calc. in terms of the corresponding frequencies of CD_3X , MeX , and $MeCl$ by means of the relation $\nu_{CD_3Cl} = (\nu_{CD_3X})(\nu_{MeCl})/(\nu_{MeX})$. The agreement is good where Me and CD_3 groups are concerned, but not so good for the series H_2O-D_2O , H_2S-D_2S , H_2Se-D_2Se , where the structure of the mols. is quite different. There is no theoretical derivation of the rule. A. J. M.

Intensity of lines of dispersion of combination in solutions of different dilution as a function of concentration. M. M. Suschtschinski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **33**, 18—21).—In the case of mixtures of cyclohexane and C_6H_6 the intensity of the lines of dispersion of combination \propto concn. With mixtures of dioxan (I) and C_6H_6 , the intensity of the 837-cm. $^{-1}$ line of (I) decreases much more slowly than concn., whereas that of the 2843-cm. $^{-1}$ line \propto concn. The 837-cm. $^{-1}$ line of (I) lies very near to the strong 849-cm. $^{-1}$ line of C_6H_6 , and the absence of proportionality may be explained by superposition. A. J. M.

Raman spectra of hydrocarbons. I. Δ^a -Octene, cis- + trans- Δ^b -octene, trans- Δ^c -octene, trans- Δ^d -octene, Δ^e - and Δ^f -octinene. F. F. Cleveland (*J. Chem. Physics*, 1943, **11**, 1—6).—Raman frequencies, intensities, and depolarisation factors are recorded. L. J. J.

Raman spectra and structure of ketonic complexes of antipyrine and of carvone. F. J. Taboury (*Compt. rend.*, 1942, **214**, 764—767).—Raman data are reported for antipyrine and for its cryst. derivative with 1 mol. of chloral hydrate. The 1500—1600-cm. $^{-1}$ lines are attributed to C:C linkings, and the 1600—1700-cm. $^{-1}$ lines to the ketonic C:O; of these, the 1658-cm. $^{-1}$ line of antipyrine is displaced and weakened in the complex, indicating that the liaison of the two mols. depends on the C:O group and not on the two N atoms. Raman data for carvone and for its cryst. derivative with 1 mol. of H_2S show that the ketonic 1676-cm. $^{-1}$ line is correspondingly modified in the complex. N. M. B.

Ionisation and dissociation by electron impact: (a) *n*-propyl chloride and *tert*-butyl chloride; (b) isobutylene, propane, and propylene. D. P. Stevenson and J. A. Hipple (*J. Amer. Chem. Soc.*, 1942, **64**, 2766—2768, 2769—2772).—(a) The mass spectra of Bu^rCl and Pr^aCl are given and appearance potentials of some ions in these spectra have been measured. The vertical ionisation potential of Pr^aCl is 10.7 ± 0.2 e.v. An estimate of D (Me—H) from the pressure data gives 4.4 ± 0.2 e.v., in agreement with other electron impact data.

(b) Mass-spectroscopic investigations of the ionisation and dissociation of C_3H_8 , C_3H_6 , and *iso*- C_4H_{10} by electron impact yield vals. for the vertical ionisation potentials of 9.8 ± 0.1 , 11.2 ± 0.1 , and 8.9 ± 0.1 e.v. The mass spectrum of *iso*- C_4H_{10} is given in detail and the significance of some of the observed appearance potentials of ions in this spectrum is discussed. W. R. A.

Theory of electrical discharge in liquids of simple structure. R. Kronig (*Z. Physik*, 1941, **118**, 452—454).—Zener's theory of electrical discharge through solid dielectrics is applicable to simple liquids. Data for liquid A are in agreement. L. J. J.

Bond energy, bond distance, and nature of the covalent linking. A. Burawoy (*Trans. Faraday Soc.*, 1943, **39**, 79—90).—Analysis of observed bond energies and bond distances indicates that the stability of covalent linkings will be due to (1) the fundamental covalent forces, (2) Coulomb forces, and (3) forces connected with deformation. Covalent linkings that can to a varying degree possess a polar character cannot be described in terms of ideal classical structures, e.g., as resonance hybrids between ideal covalent and ideal ionic linkings, such an interpretation being inconsistent with the data. F. L. U.

Polarisability of molecules and intermolecular forces. M. V. Volkenshtein (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 185—188).—Mathematical. Consideration of the effect of anharmonicity and anisotropy in electronic oscillators predicts changes in mol. consts. associated with the anisotropy of the polarisability tensor, without change in refraction, as found experimentally for the Kerr effect and depolarisation of Rayleigh scattering. The theory is applied to Raman intensities. L. J. J.

Dipole moment, induction, and resonance in nitroethane and chloronitroparaffins. E. C. Hurdis and C. P. Smyth (*J. Amer. Chem. Soc.*, 1942, **64**, 2829—2834).—Vals. of μ , calc. from measurements of the dielectric consts. of the vapours of $EtNO_2$, $CH_2Cl \cdot NO_2$, $CHMeCl \cdot NO_2$ and $CH_2EtCl \cdot NO_2$, are given. Re-determination of μ for CO_2 , C_6H_6 , H_2O , and *n*- C_8H_{18} vapours gave vals. in good agreement with existing data. The vals. for nitroparaffins indicate that inductive effects are inappreciable beyond the first two C in the chain. In the chloronitroparaffins the increases in μ in ascending the series indicate increased stabilisation of resonating polar forms by the distribution of the negative charge over two groups in the disubstituted compounds instead of the localisation on one group in the monosubstituted compounds. W. R. A.

Dipole moment and molecular structure. III. Dipole moments of diethyl esters of substituted malonic acids. N. L. Phalnikar. **IV. Dipole moments of glyptals.** N. V. Sathe, N. L. Phalnikar, and B. V. Bhide (*J. Univ. Bombay*, 1942, **11**, A, Part 3, 87—91, 92—95).—III. Dipole moments in C_6H_5 of $CMe_2(CO_2Et)_2$ (2.32), $CEt_2(CO_2Et)_2$ (2.10), $CPr^a_2(CO_2Et)_2$ (2.15), and $CPr^b_2(CO_2Et)_2$ (2.40 D.), combined with certain assumptions about the positions taken up by the CO_2Et groups (cf. Bhatkande *et al.*, A., 1942, I, 227), indicate that the vals. are in accordance with the valency deflexion hypothesis.

IV. Dipole moments in dioxan of the resins formed from glycerol

and $o\text{-C}_6\text{H}_4(\text{CO})_2\text{O}$ increase from 1.85 to 6.88 D. with increasing time of formation. Anomalous dispersion occurs at 30–150 m. and the measurements were made at 300 m. F. R. G.

Dipole moment of *ms*-tetraphenylporphine. W. D. Kumler (*J. Amer. Chem. Soc.*, 1942, **64**, 2993–2994).—*ms*-Tetraphenylporphine has zero dipole moment and is, therefore, symmetrical and has the giant and pyrrole rings in one plane. The C_6H_5 rings do not appear to have free rotation and, consequently, *o*- and *m*-substituents on these rings should give rise to stereoisomeric forms. W. R. A.

The magnetic ion. F. Ehrenhaft and L. Banet (*Science*, 1942, **96**, 228–229; cf. A., 1942, I, 222).—Some particles of a minute amount of Fe, Ni, Mn, Cr, or Sb, placed in the centre of the lower "magnetron" of a powerful magnet, move towards the upper pole. If the metal is placed in both magnetrons, some particles from each source move towards the opposite pole. Particles in a Ni sol behave likewise. These observations are discussed on the basis of magnetic ions analogous to electric ions. E. R. R.

Physical properties and chemical constitution. VII. Alkyl sulphides, disulphides, sulphites, sulphates, and orthophosphates. A. I. Vogel and D. M. Cowan (*J.C.S.*, 1943, 16–24).—[R] and parachors of $\text{RR}'\text{S}$, R_2S , R_2S_2 , Ph_2Se , R_2SO_3 , $\text{EtSO}_2\cdot\text{OEt}$, R_2SO_4 , and R_3PO_4 have been determined, and the contributions of S in disulphides, and of O in sulphites, sulphates, and orthophosphates, are calc. A. Li.

Dispersion of the Kerr phenomenon of carbon disulphide. G. Bruhat, C. Corolleur, and G. Raoult (*Compt. rend.*, 1942, **214**, 740–742).—The ratio B/B_0 of the Kerr const. for CS_2 has been determined for λ 2699 and 2754 Å., a Hg arc with a const. B_0 relative to the 4054-Å. line being used. J. L. E.

Ionic character of links and the polarity of molecules. II. M. E. Diatkina (*J. Phys. Chem. Russ.*, 1941, **15**, 597–614).—From the dipole moments, at distances, etc., the relative abundance of various isomeric forms is calc. H_2O contains 23% of homöopolar $\text{H}\cdot\text{O}\cdot\text{H}$, 21% of $\text{H}^+\text{O}^-\text{H}$, 4.5% of HOH^+ , and >51% of the three transition forms. J. J. B.

Rasumovskii's theory of the structure of organic compounds. M. Diatkina (*J. Phys. Chem. Russ.*, 1941, **15**, 694–696).—Rasumovskii's theory (A., 1941, II, 277) is criticised. J. J. B.

III.—CRYSTAL STRUCTURE.

Lattice constants, atomic radii, and valency electron concentration. H. Perlitz (*Metallwirts.*, 1941, **20**, 555–557).—A review. C. E. H.

Long range of regular atomic spacing in mixed crystals. B. L. van der Waerden (*Z. Physik*, 1941, **118**, 473–488).—Theoretical. A combination method is employed to show that long-range regularity of inter-component spacing in mixed crystals holds at temp. < a definite limit, for plane and three-dimensional rectangular lattices. Lattice irregularities are shown to involve only a small fraction of lattice spaces. L. J. J.

Intercalation of ferric chloride in the graphite crystal lattice. W. Rüdorff and H. Schulz (*Z. anorg. Chem.*, 1940, **245**, 121–156).—Graphite and anhyd. FeCl_3 were heated at 180–500°, and excess of FeCl_3 was sublimed. With increasing temp. of prep. the amount of residual FeCl_3 decreased from 72% to 5%. The X-ray pattern of FeCl_3 was absent and only part of the FeCl_3 was removed by H_2O , EtOH , or Et_2O . Up to ~57% of FeCl_3 the electrical conductivity is approx. the same as for pure C, but it decreases with further increase in $[\text{FeCl}_3]$. X-Ray patterns of the various products are discussed. With high $[\text{FeCl}_3]$ the FeCl_3 has its normal lattice structure but with an increase in the Fe^{+++} plane distances. FeCl_3 and C layers are alternate. As $[\text{FeCl}_3]$ decreases the no. of C layers increases and for 30–37% of FeCl_3 there are 3 C layers to 1 of FeCl_3 . The introduction of FeCl_3 into graphite does not alter the magnetic moment of Fe^{+++} , thus ruling out at. linking between C and Fe. Of other halides examined only SbCl_3 behaved similarly. C-FeCl_3 reacts with liquid NH_3 at 0° to form a hexammine. C. R. H.

Positions of carbon atoms in martensite. N. J. Petch (*Iron and Steel Inst.*, Feb., 1943, *Advance copy*, 7 pp.).—The variation in size of the martensite interstices with C content, and the fact that the lattice is tetragonal, indicate that the C atoms are at the mid-points of the long edges of the cell, and at the centres of the faces perpendicular to them. The C atoms are surrounded by octahedra of Fe atoms. If all these positions were filled it would require 2 C atoms per unit cell, but the observed max. C content is 0.16 per unit cell. A. J. M.

Crystal structure of cordierite. A. Byström (*Arkiv Kemi, Min., Geol.*, 1942, **15**, B, No. 12, 7 pp.).—The crystal structure of cordierite has been reinvestigated, and the formula $\text{Mg}_2\text{Al}_4\text{Si}_5\text{O}_{18}$ has been confirmed. The space-group is $D_{2d}^{20}\text{-Cccm}$. The structure is similar to that of beryl. The interat. distances are given. A. J. M.

Characteristics of soap hemihydrate crystals. M. J. Buerger (*Proc. Nat. Acad. Sci.*, 1942, **28**, 529–535).—The crystallographic charac-

teristics of single crystals of Na stearate and Na palmitate have been studied and the de Jong-Bourman photographs which are presented show that the mols. have the form $2\text{Na stearate}, \text{H}_2\text{O}$. J. L. E.

Structure of stilbene derivatives. Structure of 4 : 4'-dihydroxy- $\alpha\beta$ -diethylstilbene. G. Giacomello and E. Bianchi (*Gazzetta*, 1941, **71**, 667–676).—The *trans*-structure of 4 : 4'-dihydroxy- $\alpha\beta$ -diethylstilbene (+EtOH) (I) (cf. Kuwada *et al.*, A., 1940, II, 215; 1941, II, 320; Wessely *et al.*, *Ber.*, 1941, **74**, [B], 777) is confirmed crystallographically. 4 : 4'-Dimethoxy- $\alpha\beta$ -diethylstilbene, also of *trans*-structure, crystallising without EtOH, can be compared with œstrone (II) : it has the same space-group as (II), which it very closely resembles in cell dimensions. Thus (I) and (II) are sterically as well as physiologically analogous. E. W. W.

Determination of space-groups of crystals of diphenylbenzamide and anisic acid. R. K. Rokade, R. H. Khabaria, and M. R. Kapadia (*J. Univ. Bombay*, 1942, **11**, A, Part 3, 37–44).—The unit cell of NBzPh_2 contains 8 mols.; the axes from rotation photographs are a 17.65, b 9.060, c 17.96 Å. and the space-group is Qh^{16} . $p\text{-OMe}\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{H}$ has a unit cell containing 4 mols.; the apparent axes are a 16.94, b 10.94, c 3.953 Å., but the true unit cell has a 16.82 Å., β 94° 54'; space-group C_{2h}^5 . F. R. G.

Electron polarisation. C. G. Shull, C. T. Chase, and F. E. Myers (*Physical Rev.*, 1943, [ii], **63**, 29–37).—Experiments on double scattering of a 400-ke.v. beam of electrons by thin Au foils give a polarisation asymmetry of 8% which becomes 1% in the opposite direction on replacing one Au foil by an Al foil. A reflexion-transmission effect (cf. Chase and Cox, A., 1940, I, 387) is confirmed, and plays an important part in the polarisation experiments. A polarisation experiment with electrons reflected from the foils produces a much smaller asymmetry than with transmitted electrons. A final polarisation ratio of 1.12 ± 0.02 is obtained. N. M. B.

Polarisation of electrons. E. Trownson and J. A. Simpson, jun. (*Physical Rev.*, 1943, [ii], **63**, 55).—Previous experiments (cf. preceding abstract) are repeated with apparatus redesigned to minimise spurious asymmetries. The apparent asymmetry due to polarisation for Au is 6.8%, and for Al –2.1%. The reflexion-transmission ratio for Au and Al foils is 1.49. N. M. B.

Effect of oblique incidence on the conditions for single scattering of electrons by thin foils. G. Goertzel and R. T. Cox (*Physical Rev.*, 1943, [ii], **63**, 37–40).—Mathematical. With electrons obliquely incident on a thin foil serious deviations may be caused by the combination of two deflexions of the same order of magnitude. Consequences are discussed (cf. preceding abstracts). N. M. B.

Electron diffraction study of the structure of cadmium iodide. S. G. Pinsker (*J. Phys. Chem. Russ.*, 1941, **15**, 559–576).—Measurements of spacings and intensities of electron diffraction lines from thin CdI_2 films prepared from EtOH, or by sublimation, show three structures having (i) a 4.24 ± 0.1 , c 6.835 Å., space-group D_{3d}^{34} ; (ii) a 4.24 ± 0.1 , c 13.67 Å., space-group C_{6h}^4 ; and (iii) a 4.24 ± 0.1 , c 20.50 Å., space-group D_{3d}^{34} . Crystals obtained by slow crystallisation have the structure (ii). J. J. B.

Molecular structure of methyl isocyanide. W. Gordy and L. Pauling (*J. Amer. Chem. Soc.*, 1942, **64**, 2952–2953).—From electron-diffraction measurements MeNC is linear with $\text{Me-N} = 1.44 \pm 0.02$ and $\text{N-C} = 1.18 \pm 0.02$ Å. W. R. A.

Electron diffraction of retene and β -methylantracene crystals. V. L. Karpov (*J. Phys. Chem. Russ.*, 1941, **15**, 577–591).—Transmission patterns of mono- and poly-cryst. films and the intensities of the spots show that retene has a 6.25, b 8.51, c 23.4 Å., and belongs to a space-group C_{2v}^{10} , D_2^2 , or D_2^4 ; β -methylantracene has a 7.7 and b 5.8 Å. J. J. B.

Dependence of magnetic properties of a substance on frequency. K. M. Polivanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 181–184).—Ferromagnetic substances show variation of μ with frequency due to both macroscopic and microscopic non-homogeneity. The latter is determined by the presence of Weiss regions. L. J. J.

Number of fine structure lines of Rayleigh scattering in optically aelotropic crystals. V. V. Vladimirovski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **31**, 866–867).—It is shown that the Rayleigh line of an optically aelotropic crystal consists of 24 satellites with changed frequencies, and one with the primary frequency. Under certain conditions some of the lines coincide, e.g., if an incident or scattered light wave is propagated along the optical axis, the no. of satellites is reduced, so that the Rayleigh line then has 13 components. Where the optical aelotropy is small, the satellites will group in fours. A. J. M.

Statistical lengths of rubber-like hydrocarbon molecules. F. T. Wall (*J. Chem. Physics*, 1943, **11**, 67–71).—The root mean square lengths of *trans*-, *cis*-, and random rubber-like hydrocarbon mols. are calc. The max. possible lengths for *cis*- and *trans*-mols. are also obtained. The *cis*-structure should be more elastic than the *trans*-, which is in qual. agreement with practice, though the calc. difference in elasticity is not great enough, especially at room temp. Polychloroprene has a *trans*-structure, yet possesses considerable elasticity.

Balata, on the other hand, lacks elasticity, and steric influences account for this. A. J. M.

Frictional phenomena. XI. c. Solids. A. Gemant (*J. Appl. Physics*, 1942, 13, 688—696).—The general features of plastic flow in solids are reviewed and illustrated by experimental data, and the Prandtl model of plastic properties is discussed. The theories of Becker and Orowan, and of Polanyi and Taylor, are also considered. Although the mechanisms of viscous flow in liquids and plastic flow in solids are similar, a liquid flows at any point and in any direction, whereas in a solid flow develops near flaws and in crystallographically determined directions. A. J. E. W.

IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

Behaviour of solid electronic semi-conductors at dissociation. E. I. Mokeeva and N. I. Mokeeva (*J. Phys. Chem. Russ.*, 1941, 15, 686—687).—The conductivity (κ) of ZnCO_3 at 25—100° complies with Ohm's law. At 135—150° ZnCO_3 dissociates, and κ rises by a factor of 10—40 within 10 min., and drops again to 0 in the next 10—15 min. The behaviour of MnO_2 is similar. J. J. B.

Theory of superconduction. A. Sommerfeld (*Z. Physik*, 1941, 118, 467—472).—Welker's theory of superconductivity (cf. A., 1939, I, 132) is consistent with the Gorter-Casimir-Kok thermodynamic relation. Misener's data (A., 1940, I, 201) for threshold curves agree with Welker's theory in the case of Tl, but not in that of Hg and In. L. J. J.

Ionic [diamagnetic] susceptibility of barium. M. Prasad, S. S. Dharmatti, and C. R. Kanekar (*Proc. Indian Acad. Sci.*, 1942, 16, A, 307—318).—The susceptibilities of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$, $\text{BaBr}_2 \cdot 2\text{H}_2\text{O}$, $\text{Ba(NO}_3)_2$, BaCO_3 , BaSO_4 , BaSeO_4 , $\text{Ba(ClO}_3)_2 \cdot \text{H}_2\text{O}$, BaCrO_4 , BaSeO_3 , $(\text{HCO}_2)_2\text{Ba}$, Ba(OAc)_2 , BaC_2O_4 , $(\text{CH}_3\text{CO}_2)_2\text{Ba}$, $(\text{OH} \cdot \text{CH} \cdot \text{CO}_2)_2\text{Ba}$, $(\text{CO}_2\text{H} \cdot \text{C}_6\text{H}_4 \cdot \text{CO}_2)_2\text{Ba} \cdot \text{H}_2\text{O}$, and $(\text{OH} \cdot \text{C}_6\text{H}_4 \cdot \text{CO}_2)_2\text{Ba}$ have been measured and a val. for $\chi_{\text{Ba}^{++}}$ has been deduced in good agreement with theoretical vals. calc. by the methods of Slater and Angus. W. R. A.

Magnetochemical investigations. XLIII. Magnetic behaviour of the nickel complexes with nitrilotriacetic acid and with ethylenediaminetetra-acetic acid. XLIV. Magnetic behaviour of some inner complexes of imines of salicylaldehyde. W. Klemm and K. H. Raddatz. **XLV. Ionic diamagnetism. Addendum to I and II.** W. Klemm (*Z. anorg. Chem.*, 1942, 250, 204—206, 207—222, 223—225).—XLIII. Ni ethylenediaminetetra-acetic acid and nitrilnickel acetate exhibit paramagnetic properties of the same order as those of the Ni ion; they are probably penetration complexes with a tetrahedral configuration.

XLIV. Ni complexes of salicylaldehyde-imine, -methylimine, -ethylenedi-imine, and -o-phenylenedi-imine are diamagnetic and are therefore planar penetration complexes. The *salicylaldehyde-methylimine complex*, for which two methods of prep. are given, also exists in a paramagnetic form. Salicylaldehyde-ethylenedi-imine- Co^{III} hydroxide is diamagnetic or weakly paramagnetic. Salicylaldehyde-o-phenylenedi-imine- Fe^{III} chloride is a normal complex. Salicylaldehyde-ethylenedi-imine- Fe^{III} chloride and oxide are intermediate complexes comparable with Fe compounds of phthalocyanine. Salicylaldehydeimine- Fe^{III} is also an intermediate complex, although its properties are close to those of a normal complex.

XLV. Comparison is made between vals. of ionic diamagnetic increments previously reported by the author (cf. A., 1943, I, 261) and those of Trew (cf. A., 1941, I, 404). C. R. H.

Refractive indices of gases at high radio frequencies. F. J. Kerr (*Proc. Physical Soc.*, 1943, 55, 92—98).—A detailed account of measurements, by the standing wave method, previously reported for dry air and H_2O vapour (cf. A., 1942, I, 167). N. M. B.

Reflexion of light by a periodically stratified medium. G. A. Ramachandran (*Proc. Indian Acad. Sci.*, 1942, 16, A, 336—348).—Mathematical. W. R. A.

Properties of optical glasses with chemically altered surfaces. II. H. Schröder (*Z. tech. Physik*, 1942, 23, 196—208; cf. *ibid.*, 1941, 22, 38).—The transparency of a polished glass surface after treatment with acid falls slowly on keeping, and is changed by heat-treatment owing to H_2O -adsorption effects at the surface. A study of the effects of temp. changes in the range 25—200° on the reflectivity of a dense crown glass shows the existence of a reversible (adsorption) and an irreversible process (sintering of a porous surface layer). The adsorption effects are studied in detail, and isotherms similar to that of Langmuir are obtained. Typical capillary condensation phenomena occur at saturation H_2O pressures. At 20° and 70% R.H. the adsorbed H_2O layer is ≥ 5.5 mols. thick. The sintering process causes the surface layer of the glass to shrink by $\geq 10\%$ and increases its chemical stability. A. J. E. W.

Refractive indices and densities of normal saturated fatty acids in the liquid state. A. Dorinson, M. R. McCorkle, and A. W. Ralston (*J. Amer. Chem. Soc.*, 1942, 64, 2739—2741).—Vals. of n at 20—80° and of ρ at 80° have been measured for n -fatty acids from hexoic to

stearic. n varies linearly with temp. with a change in slope at 40°. Mol. vols. and refractions have been computed. W. R. A.

Specific heat of pure iron at low temperatures. K. K. Kelley (*J. Chem. Physics*, 1943, 11, 16—18).—The sp. heat of carbonyl-Fe (Fe 99.94, O < 0.001, Ni 0.03%) has been determined at 52—298° K. Vals. are 0.924, 1.407, 1.781, 2.326, 3.062, 3.725, 4.443, 4.942, 5.410, 5.952 g.-cal. per g.-atom per °K. at 54.6°, 65.6°, 73.7°, 86.2°, 105.0°, 125.5°, 155.8°, 186.0°, 225.9°, 295.1° K., respectively. $S_{298.15}^\circ$ is 6.49 ± 0.03 g.-cal. per g.-atom per degree. L. J. J.

Specific heats at low temperatures of anhydrous sulphates of iron, magnesium, manganese, and potassium. G. E. Moore and K. K. Kelley (*J. Amer. Chem. Soc.*, 1942, 64, 2949—2951).—From C_p measurements between 51° and 298° K. the following vals. of $S_{298.15}^\circ$ have been computed: FeSO_4 , 25.7 ± 0.3 ; MgSO_4 , 21.9 ± 0.2 ; MnSO_4 , 26.8 ± 0.3 ; and K_2SO_4 , 42.0 ± 0.6 g.-cal. per °K. per g.-mol. Computed vals. of ΔG , based on third law of thermodynamics calculations, are given. W. R. A.

Theoretical properties of dense hydrogen. C. L. Critchfield (*Astro-phys. J.*, 1942, 96, 1—10).—The limits of ρ (0.66 to 1.12×10^7) within which H can exist as a metallic solid are deduced from theoretical considerations. The thermal conductivity is such that a layer of the cryst. solid might transfer the heat produced by radioactive reactions within the core of planets, thus replacing the H_2O layer of Wildt's theory. The Curie point for proton ferromagnetism is estimated, and the consequences of a large amount of H near the surface of white dwarf stars are discussed. E. R. R.

Density and refractive index of cumene. J. E. Troyan (*J. Amer. Chem. Soc.*, 1942, 64, 3056).—Pyknetometric vals. of ρ_4^θ and n_D^θ are representable by an expression of the form $a + b\theta + c\theta^2$. $\rho_4^{20} = 0.8620$, $n_D^{20} = 1.4911$. W. R. A.

Surface tension and vapour pressure. L. Z. Pollara (*J. Physical Chem.*, 1942, 46, 1163—1167).—The empirical relation $T \log p = -a\gamma[M/(D-d)]^{2/3} + b$, where M = mol. wt., D and d are densities of liquid and vapour respectively, γ = surface tension, p = v.p. and a and b are consts., is proposed. From it an equation connecting p with T , the b.p., and crit. consts. and a new form of Trouton's ratio are derived. C. R. H.

Vapour pressure nomogram for isomeric octanols. D. S. Davis (*Ind. Eng. Chem.*, 1943, 35, 232).—The nomogram given covers the temp. range 50—190° and the v.p. range 15—800 mm., for 22 octanols, and is based on the data of Dorough *et al.* (A., 1942, II, 128). L. J. J.

Vapour pressure of phenylhydrazine as a function of temperature. G. E. Williams and E. C. Gilbert (*J. Amer. Chem. Soc.*, 1942, 64, 2776—2777).—The v.p. of $\text{NHPh} \cdot \text{NH}_2$, measured at 105—192° with a precision of $\sim \pm 0.4$ mm. by an isoteniscope, can be expressed by an empirical equation of the form $\log P = A - B/(\theta + 230)$. The latent heat of vaporisation at 25—240° has been calc. W. R. A.

Vapour pressure of phenothiazine. O. A. Nelson and L. E. Smith (*J. Amer. Chem. Soc.*, 1942, 64, 3035—3037).—The v.p. of phenothiazine at 63—121° and the rate of evaporation of the finely-powdered substance at 45° have been determined. The loss in toxicity is not due to evaporation. W. R. A.

Thermodynamic theory of the equation of state. A. M. Rosen (*J. Phys. Chem. Russ.*, 1941, 15, 688—693).—The theories of Jacyna (A., 1938, I, 240) are criticised. J. J. B.

Repulsive action between a heated solid surface and adjacent gas. I. H. Spencer-Gregory (*Phil. Mag.*, 1943, [vii], 34, 120—130).—Gas-kinetic theory is applied to calculate the thermo-mol. force on a heated surface in a partially rarified gas. The cases discussed are an axial hot wire in a circular cylinder, two concentric spheres, and two parallel plates. The magnitude of the effect depends on the temp. discontinuity at the surface. Numerical vals. are given for H_2 and He for the cylindrical arrangement. H. J. W.

Viscosity of pure liquids. I. Non-polymerised fluids. II. Polymerised ionic melts. R. M. Barrer (*Trans. Faraday Soc.*, 1943, 39, 48—59, 59—67).—I. The equation $\eta = \eta_0 e^{E/RT}$ is used in the study of a large no. of pure liquids belonging to the classes (a) liquefied permanent gases and apolar compounds, (b) polar liquids, (c) H- and OH-bonded liquids, (d) liquid metals, and (e) ionic liquids. E , the energy of activation, varies with the nature of the liquid, and may vary with or be nearly independent of T . The zone theory of viscous flow (cf. A., 1942, I, 362) gives a satisfactory account of various properties of η_0 . *E.g.*, the graphs of $-\log \eta_0$ with E are straight lines of which the slopes and intercepts on the $-\log \eta_0$ axis increase with decrease of T , whilst the graphs of $-\log \eta_0$ with E/T are parallel straight lines; in both cases the intercepts are separated approx. by $\log T_1/T_2$ for two temp. T_1 and T_2 , and the relations are independent of the nature of the liquid.

II. For glasses and polymerised ionic melts E may be very large and frequently depends on T . The relation between η_0 and E/T is expressed by $-\log_0 \eta_0 = 0.115E/T(1 + 0.00152E/T)$; this equation is virtually linear over the range $E/T = 8.6—100$. The straight line has, however, a slope and intercept different from

those for mol. and non-polymerised fluids. The zone theory is used to explain these results. In many of the systems examined (including non-polymerised fluids) the no. of degrees of freedom in each zone, the zone vol., and the total energy per activated degree of freedom necessary for flow to occur are calc. F. L. U.

V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

Compressibility of gas mixtures. II. Equation of state for gas mixtures. V. P. Markov (*J. Phys. Chem. Russ.*, 1941, 15, 410—415).—Several equations of state are tested on mixtures of H_2 and CO_2 , N_2 and H_2 , etc. The equation given by Kritschewski and Kasarnovski (cf. A. 1939, I, 605) agrees best with the measurements. J. J. B.

Second virial coefficients of gaseous mixtures. A. E. Edwards and W. E. Roseveare (*J. Amer. Chem. Soc.*, 1942, 64, 2816—2819).—The theory and practice of a method of determining the second virial coeffs. of gaseous mixtures are described. The method gives data for mixtures corresponding in accuracy with those obtained by gas density measurements to $\sim 0.002^\circ$. Vals. for the second virial coeffs., B_{12} , at 25° are given for nine mixtures (H_2-N_2 , H_2-CO_2 , N_2-CO_2 , O_2-CO_2 , $H_2-C_2H_6$, $CO_2-C_2H_6$, $N_2-C_2H_6$, $He-N_2$, $He-CO_2$) and vals of B_{11} for each of these have been plotted as functions of the compositions of the mixtures. W. R. A.

Coefficients of thermal diffusion of neon and argon and their variation with temperature. L. G. Stier (*Physical Rev.*, 1942, [II], 62, 348—351; cf. Nier, A., 1940, I, 203).—Measurements of the thermal diffusion consts. α in seven temp. intervals over $90-720^\circ K.$ are reported. For both gases $\alpha \propto \log T$. Results are compared with vals. obtained from viscosity data and measurements on binary gas mixtures. There is poor agreement with vals. calc. from the Sutherland and Lennard-Jones models. Negative vals. of α predicted by the model near the crit. temp. of A are not observed. N. M. B.

Physical properties of very dilute solutions. O. Reinkober (*Naturwissenschaften*, 1942, 30, 603—604).—The infra-red absorption of NO_2 in solutions of KNO_3 of different concn. has been investigated in order to test the results of Heintz (A., 1942, I, 393) on the special properties of progressively diluted solutions. The statements made by Heintz could not be verified, the absorption curves for dil. solutions showing the same smooth course as for pure H_2O . A. J. M.

Osmotic pressure. E. C. Craven (*Chem. and Ind.*, 1943, 36—37).—When n mols. of non-volatile solute are dissolved in N mols. of solvent, it is assumed that each solute mol. influences one solvent mol. so that it cannot leave the liquid surface, i.e., only $N - n$ mols. of solvent are able to leave. The fall in v.p. ($\propto (N - n)/N$) is thus due to a reduction in the no. of mols. able to evaporate. This view of osmotic pressure is suggested as being more understandable than the somewhat abstract view usually adopted. C. R. H.

Van't Hoff theory of the Soret effect (osmotic pressure in non-isothermal systems). K. Wirtz (*Z. Physik*, 1941, 118, 510—514).—The assumption of const. osmotic pressure P in non-isothermal liquid systems, leading to the relation $n_{T_1}/n_{T_2} = T_2/T_1$ for the concn.-temp. gradient effect, is in disagreement with experimental data. P varies with temp. in a manner which can be expressed as a function of the Soret coeff. L. J. J.

Variation in the structure of water in ionic solutions. II. G. W. Stewart (*J. Chem. Physics*, 1943, 11, 72—74).—An extension of earlier work (A., 1940, I, 25) to 38 strong electrolytes confirms the correspondence between rates of variation of partial molal ionic vol. with concn., and the rate of variation of H_2O structure as approx. indicated by the X-ray diffraction pattern. The effect of concn. on adiabatic compressibility and of solubility on the variation of H_2O structure is considered. The effect of ions on H_2O structure, adiabatic compressibility, and temp. of min. compressibility can be qualitatively explained by supposing that increase of temp. and the presence of ions breaks the H bonds, altering the H_2O structure and decreasing its molal vol., and also causes increase in molal vol. by expansion. A. J. M.

Solvent polarisation error and its elimination in calculating dipole moments. I. F. Halverstadt and W. D. Kumier (*J. Amer. Chem. Soc.*, 1942, 64, 2993—2992).—The increasing curvature in polarisation-concn. curves as concn. decreases leads to false vals. for μ calc. by extrapolation to zero concn., and to false vals. for association factors computed on the assumption that curvature indicates association. A new method of calculating polarisations at infinite dilution, which eliminates solvent polarisation, is described and has been applied successfully in several cases reported to be anomalous. W. R. A.

Molar dispersion and refraction of free and bonded ions. N. Bauer and K. Fajans (*J. Amer. Chem. Soc.*, 1942, 64, 3023—3034).—Molar dispersion (Δ) is measured by the difference between R_D and R_∞ , the molar refractions (Lorentz-Lorenz) for the Na-D line and $\lambda = \infty$ extrapolated from measurements in the visible; Δ for isoelectronic substances is representable by a single-term formula in the visible and is approx. $\propto R_D^2$. This relation holds for the

inert gases, H halides, H_2O , H_2S and H_2Se . For free gaseous ions of the inert gas type, the dispersion, Δ , is obtained from the corresponding vals. of R and λ for inert gases, and from the gradations of Δ with gradations of the experimental molar dispersions for aq. electrolytes the effect of hydration on the apparent ionic dispersion has been estimated. Δ is more sensitive than R to changes in the forces acting on the electronic systems of ions and mols. and the relative changes in Δ are approx. twice those in R_D . W. R. A.

Calcium chloride nomographs. D. S. Davis (*Ind. Eng. Chem.*, 1942, 34, 1393—1394).—Nomographs permitting calculation of the concn. and i.p. of a 6—34% $CaCl_2$ solution from its d at any temp. between 10° and 30° are given. J. W. S.

System anhydrous aluminium chloride in liquid sulphur dioxide. II. Specific gravity of solutions. U. Tesi (*Gazzetta*, 1942, 72, 142—145).—The sp. gr. of solutions of $AlCl_3$ of varying concn. in liquid SO_2 at -20° , 0° , 25° , and 50° is determined in a glass pycnometer with metal top and tap. E. W. W.

System water-glucose as an example of the "ideal" solubility. E. Pozner and A. C. Amirchanov (*J. Phys. Chem. Russ.*, 1941, 15, 1137—1138).—From supercooled aq. solutions of glucose ice deposits in the range 0—71% of glucose, and the f.p. curve agrees with that expected from "ideal" solutions. J. J. B.

Solidification point nomograph for fatty acids. D. S. Davis (*Ind. Eng. Chem.*, 1943, 35, 105).—A nomograph, which gives the f.p. lowering of fatty acids due to the presence of H_2O , is reproduced. It is applicable to the normal saturated C_4-C_{18} fatty acids. C. R. H.

High mol. wt. aliphatic amines and their salts. IX. Behaviour of various salts of dodecylamine in water, ethyl alcohol, and benzene. C. W. Hoerr and A. W. Ralston (*J. Amer. Chem. Soc.*, 1942, 64, 2324—2329).—The solubilities of dodecylammonium formate, acetate, propionate, n -butyrate, chloride, bromide, iodide, dodecylcarbamate, primary and sec. phosphates, and H and normal sulphates, $C_{12}H_{25}NH_2MeCl$, and $NHMe_2C_{12}H_{25}$ chloride and acetate have been determined in H_2O , EtOH, and C_6H_6 . The phase changes of the H_2O systems of $NH_2C_{12}H_{25}$ formate, acetate, propionate and $C_{12}H_{25}NHMe_2OAc$ have been investigated, and the hydrates formed by these salts are given. The osmotic coeff. of the salts in aq. solution is independent of the acid radical, and shows an abrupt decrease when the concn. reaches $\sim 0.1M$ owing to micelle formation. Mol. association of $Pr^+CO_2NH_2C_{12}H_{25}$ in C_6H_6 is discussed. W. R. A.

Generalisation of the Gibbs-Curie theorem for mixed crystals. V. K. Sementschenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 175—177).—The effect of admixtures on equilibrium crystal form depends on the manner of their adsorption at the liquid-crystal interface. Positive adsorption retards crystal growth at low concn. and accelerates it at high concn.; negative adsorption has the reverse effect. L. J. J.

Photo-electric alloys of alkali metals. A. Sommer (*Proc. Physical Soc.*, 1943, 55, 145—154).—A detailed account of studies previously reported for $SbCs_3$ (cf. A., 1942, I, 17). $SbRb_3$, SbK_3 , $BiCs_3$, and an As-Cs alloy have been produced. They show photo-electric sensitivity of much lower order than $SbCs_3$, have a more metallic character, and their sp. resistance is similar to that of metallic conductors. N. M. B.

Diagram of state for the nickel-niobium system. S. A. Pogodin and A. N. Zelikman (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 595—597).—Thermal analysis indicates the existence of an α phase from 0 to 23.5% Nb, consisting of a solid solution of Nb in Ni, a β phase from 23.5 to 51.6% Nb, consisting of a solid solution of Nb in Ni_3Nb , and from 51.6% Nb upwards another compound, probably $NiNb$, which separates as a γ phase. There are two eutectics, one on each side of Ni_3Nb . One consists of α and β phases, contains 23.5% Nb, and has m.p. 1270° . The second has m.p. 1175° . The hardness of these alloys has been investigated. The solubility of Nb in Ni was studied by examining the microscopic structure of a series of Nb-Ni alloys. A. J. M.

Diffusion rate of carbon in iron-cobalt alloys. R. Smoluchowski (*Physical Rev.*, 1942, [II], 62, 539—544).—Direct measurement confirms the accelerating influence of Co on the rate of diffusion of C in γ -Fe, and an increase in the diffusion coeff. is established. Addition of 4% of Co decreases the activation energy from 32,500 to 30,000 g.-cal., corresponding with $\sim 100\%$ increase of the diffusion rate at 1 at.-% C concn. At higher C contents the accelerating influence is smaller. N. M. B.

Determination of valency from X-ray absorption spectra.—See A., 1943, I, 73.

Solubility of hydrogen in n -butane. E. E. Nelson and W. S. Bonnell (*Ind. Eng. Chem.*, 1943, 35, 204—206).—The solubility (S) of H_2 in n - C_4H_{10} has been determined at 23.9° , 32.2° , and 115.6° , at 22—106 atm. At pressures < 30 atm. S decreases, and at pressures > 40 atm. S increases, with increase of temp. At $[H_2] > 3$ mol.-% there is a region of isobaric retrograde condensation at temp. \ll the crit. region. L. J. J.

Solubility effect in solvents of low dielectric constant. II. Solubility effect in benzene. A. A. Vernon and J. P. Masterson (*J. Amer. Chem. Soc.*, 1942, **64**, 2822—2823).—The solubilities of tetraisoamylammonium iodide in C_6H_6 solutions of tetraisoamylammonium picrate and NH_4Bu_3 picrate, and of tetra-amylammonium iodide in C_6H_6 solutions of tetra-amylammonium and NH_4Bu_3 picrates have been determined. In both cases an increase in solubility of the saturating salt was found, and the relation of this to multiple ion phenomena is noted. W. R. A.

Solubility studies. VII. Solubility of isomeric ketones in water. J. H. Saylor, V. J. Baxt, and P. M. Gross (*J. Amer. Chem. Soc.*, 1942, **64**, 2742—2744).—The solubilities of $COPr^a_2$, $COPr^b_2$, and $COMc \cdot C_6H_{11}$ in H_2O have been determined from 10° to 75°, and vapour solubilities, free energies, heats, and entropies of dissolution have been calc. The previous suggestion that equality of solute vol. as well as chemical similarity is necessary for a linear relation between entropies and heats of dissolution has been confirmed. In agreement with other isomeric ketones, large solubility differences and a large temp.-dependence of those differences were found. W. R. A.

Solubility of calcium oxalate monohydrate in water and neutral salt solutions at 25°. W. H. McComas, jun., and W. Rieman, III (*J. Amer. Chem. Soc.*, 1942, **64**, 2946—2947).—The solubility of $CaC_2O_4 \cdot H_2O$ has been determined in H_2O and in aq. solutions of $NaCl$, KCl , HCO_2NH_4 , and Na_2SO_4 at 25° at various ionic strengths up to 1.0. The H_2O -solubility is $4.55 \times 10^{-5}M$. at 25°. W. R. A.

Effect of pH on the solubility of calcium oxalate. W. H. McComas, jun., and W. Rieman III (*J. Amer. Chem. Soc.*, 1942, **64**, 2948—2949).—The semiclassical second ionisation const. K_2' of $H_2C_2O_4$ has been determined at ionic strengths (μ) from 0 to 1 in presence of $NaCl$, KCl , and NH_4Cl and the solubility of $CaC_2O_4 \cdot H_2O$ in formate buffers at $\mu = \text{const.} = 0.36$ has been measured over the pH range 5.96—2.60, in which the solubility increases from 2.23×10^{-4} to $5.89 \times 10^{-4}M$. The observed vals. agree with those calc. by the use of K_2' . W. R. A.

Aqueous solutions of aluminium oxide in alkali hydroxides. V. T. Sheth (*J. Univ. Bombay*, 1942, **11**, A, Part 3, 185).—The solubility of $Al(OH)_3$ in N - to $14N$ - $NaOH$ and $-KOH$ at 35—55° is for a sample pptd. from $Al_2(SO_4)_3$ > that of a Merck sample > that of a sample pptd. from $AlCl_3$ > that of a sample obtained by hydrolysis of $Al(OEt)_3$, and increases with concn. of the alkali and temp. The amount of Al_2O_3 pptd. by electrolyte is in the reverse order of the solubility. F. R. G.

Indium salts. II. Indium iodate. F. Ensslin (*Z. anorg. Chem.*, 1942, **250**, 199—201).—A diagram for the solubility at 20° of $In(IO_3)_3$ in HNO_3 (0—900 g. per l.) has been constructed. A max. solubility of 16.89 g. of $In(IO_3)_3$ per l. occurs at $[HNO_3] = 300$ g. per l. C. R. H.

Solubility of carbon in silicochrome.—See B., 1943, I, 168.

Solubility of secondary uranium minerals. I. E. Starik, A. G. Samartzeva, and M. L. Jaschtschenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **31**, 909—910).—The solubility of two secondary U minerals, zeunerite ($CuO \cdot 2UO_3 \cdot As_2O_5$) and an isomorphous mixture of torberite ($CuO \cdot 2UO_3 \cdot P_2O_5$) and autunite ($CaO \cdot 2UO_3 \cdot P_2O_5$), has been determined. The solubility of autunite in a natural H_2O is 1.5 times > in distilled H_2O , whilst the ratio in the case of zeunerite is 15. The solubility is < that of $BaSO_4$. A. J. M.

Solubility of melamine in water. R. P. Chapman, P. R. Averell, and R. R. Harris (*Ind. Eng. Chem.*, 1943, **35**, 137—138).—The solubility (S) of melamine in g. per 100 g. of H_2O at 20—100° is given by $\log S = -1642/T + 5.101$. L. J. J.

Adsorption of propane and propylene by silica gel and metallised silica gel. L. H. Reyerson and M. R. Cines (*J. Physical Chem.*, 1942, **46**, 1060—1068).—Palladised SiO_2 gel adsorbs C_3H_8 and C_3H_6 more strongly than does untreated SiO_2 , C_3H_6 being more strongly adsorbed than C_3H_8 . The data support the theory of Brunauer *et al.* (cf. A., 1938, I, 190). C. R. H.

Experimental study of the effect of force interactions on the adsorption process. I. Adsorption equilibrium. II. Adsorption kinetics. J. M. Goldfeld and N. I. Kobosev (*J. Phys. Chem. Russ.*, 1941, **15**, 257—274, 275—295).—I. Adsorption isotherms at 0° between 10^{-5} and 10^{-1} mm. Hg of H_2 , CO , C_2H_4 , and propylene on Cu, and of NH_3 on Fe, are measured. They do not comply with Langmuir's equation and can be accounted for by assuming that an adsorbed mol. lowers the adsorption potential U around it. The adsorption of CO on Cu containing $(CN)_2$ (e.g., 0.25—0.65 c.c. per g. of Cu) is not only < that on pure Cu but the deviation of its adsorption isotherm from Langmuir's equation is increased. If $(CN)_2$ were just blocking the adsorbing surface this deviation would have been unchanged or reduced; its increase shows that adsorbed poison mols. strongly lower the U of their neighbour mols. When the surface area of Cu is reduced by recrystallisation at 350°, the amount adsorbed (x) is less but the shape of the isotherm does not change.

II. The rate v (c.c. per sec.) of desorption of CO , H_2 , propylene,

and $(CN)_2$ from Cu, and of NH_3 from Fe, is measured at -40° to 180° . It rapidly decreases when x diminishes, and the ratio v/x decreases as well, showing that U is the higher the smaller is x . The increase of v/x with x is less marked at higher temp. $(CN)_2$ raises v/x and its increase with x for desorption of CO from Cu; this shows that the U of CO is lowered by the near-by mols. of $(CN)_2$. J. J. B.

Adsorption equilibrium and kinetics of processes on heterogeneous surfaces or in the presence of an interaction between adsorbed molecules. M. I. Temkin (*J. Phys. Chem. Russ.*, 1941, **15**, 296—332).—Mathematical. The observed adsorption can be explained by taking into account either the heterogeneity of solid surfaces or the repulsive forces between the adsorbed mols. A convenient adsorption isotherm is $\theta = [\log_e(1 + a_0p) - \log_e(1 + a_1p)]/(\log_e a_0 - \log_e a_1)$, where θ is the degree of saturation of the surface, p the gas pressure, and a_0 and a_1 are const. J. J. B.

Elimination of sorption-desorption hysteresis in hydrous oxide gels. II. Tantalum pentoxide, stannic oxide, and titanium dioxide. H. B. Weiser, W. O. Milligan, and W. C. Simpson (*J. Physical Chem.*, 1942, **46**, 1051—1059).—Extension of the investigation of sorption-desorption hysteresis in SiO_2 gel (cf. A., 1942, I, 324) to gels of Ta_2O_5 , SnO_2 , and TiO_2 confirms earlier conclusions. Theories of such hysteresis are discussed. C. R. H.

Adsorption at the crystal-solution interface. XIII. Electron diffraction investigation of crystal surfaces of pure sodium bromate and sodium bromate with adsorbed dyes. J. H. Blomquist and W. G. France (*J. Physical Chem.*, 1942, **46**, 1044—1050).— $NaBrO_3$ crystals grown in aq. dye solutions have lattice consts. different from those of pure crystals if the dye is adsorbed selectively. With other dyes the lattice consts. are unchanged. This lattice change is not regarded as due to solid solution of the dye mol. in the $NaBrO_3$ lattice, but rather to an inner potential effect. C. R. H.

Ion exchange between solid and liquid phases. I. Dependence of cation exchange on dilution. A. N. Ivanov and E. N. Gapon. II. Differential coefficients of sorption of two ions. E. N. Gapon (*J. Phys. Chem. Russ.*, 1941, **15**, 659—664, 665—672).—I. In the ion exchange between a solid salt MX and a dissolved salt BA the amount of B sorbed is independent of dilution if M and B have equal valencies; if the valency of B is > that of M , the sorption of B increases with dilution, and vice versa. These rules are deduced theoretically and supported by experiments with aluminosilicates saturated with Na or Ca and exchanging their cations with KCl , $NaCl$, and $CaCl_2$.

II. It is shown theoretically that the sorbed amount s of an ion the activity of which is a_1 and valency n_1 generally depends on the activity a_2 and valency n_2 of another competing ion, according to the equation $s = \text{const.}_1 + \text{const.}_2 \times (\log_e a_1^{1/n_1} - \log_e a_2^{1/n_2})$. J. J. B.

Adsorption analysis of some triglycerides and fatty acids. S. Claesson (*Arkiv Kemi, Min. Geol.*, 1942, **15**, A, No. 9, 9 pp.).—The adsorption method of Tiselius (A., 1943, I, 136, 139) has been applied to the adsorption of trilaurin, trimyristin, tripalmitin, and triolein in Et_2O on C, the retardation vols. being determined. With the higher fatty acids, $EtOH$ was the only solvent which gave a suitable difference in retardation vol. to enable a separation to be made. The adsorption differences between the various triglycerides and acids used are sufficiently great to enable a qual. analysis to be carried out by this method. A. J. M.

Adsorption of simple and complex cobalt ions on titanium dioxide. D. G. Nicholson (*J. Amer. Chem. Soc.*, 1942, **64**, 2820—2822).— Co^{++} ions are adsorbed from aq. or $AcOH$ solutions of $Co(OAc)_2$ by TiO_2 but the extent of adsorption is reduced when the Co^{++} ions, in $AcOH$, are co-ordinated with *o*-phenanthroline. This explains the shortened induction period characteristic of TiO_2 -pigmented drying oils containing metal-*o*-phenanthroline complex driers. W. R. A.

Fluorescence and adsorption of stilbamidine.—See A., 1943, III, 265.

Dissolution of silver halides in aqueous halogen acids as an example of the influence of surface equilibria on the rate of heterogeneous diffusion. W. Erber (*Z. anorg. Chem.*, 1942, **150**, 145—158).—The rate of dissolution (v) of Ag halides in solutions of the respective acids increases with increase in acid concn. (c). The kinetics of heterogeneous reactions are discussed, and an equation relating v to c and taking into account diffusion and conditions at the liquid-solid interface has been derived. There is good agreement between calc. and observed vals. of v for small vals. of c , but as c increases the observed val. of v increases less rapidly than the calc. val. C. R. H.

Surface tensions of methane-propane mixtures. C. F. Weinaug and D. L. Katz (*Ind. Eng. Chem.*, 1943, **35**, 239—246).—The surface tensions of CH_4 - C_3H_8 liquid-vapour equilibrium mixtures at -15° to 90° and 42—1500 lb. per sq. in. have been determined by capillary rise and drop-vol. methods. The results are in close agreement with an equation of the Fowler form in terms of the parachors and apparent molal vol. of the components in liquid and vapour phases. L. J. J.

Surface tension of solutions of electrolytes as a function of concentration. IV. Magnesium sulphate. G. Jones and W. A. Ray (*J. Amer. Chem. Soc.*, 1942, **64**, 2744—2745).—Apparent relative γ of aq. MgSO_4 (0.0001—2M.) have been measured at 25.00°. At extreme dilution MgSO_4 apparently gives a min. in the γ -M. curve, similar to those given by salts previously investigated (cf. A., 1942, I, 142). MgSO_4 increases γ of H_2O almost linearly with concn. at moderate and high concn., and behaves as a typical "capillary-inactive" substance. W. R. A.

Capillary behaviour in porous solids.—See B., 1943, I, 134.

Electron-microscopic and electron diffraction studies of the structure of volatilised metal films. G. Haas (*Kolloid-Z.*, 1942, **100**, 230—242).—Very thin Ag films consist of isolated grains, the spaces between which become filled up when the films thicken, until crystallites up to 5000 Å. long are formed when the thickness reaches 550 Å. In such films the lattice const. is 4.085 ± 0.01 Å. Films of Al are much finer-grained than films of Ag of equal thickness, and have a lattice const. of 4.05 ± 0.01 Å. In thin Sb films there is complete orientation of the crystallites with the (0001) plane parallel to the supporting surface, and the grain size is very uniform. With increasing thickness the orientation progressively decreases and faults appear in the film. F. L. U.

Formation of films from emulsions. II. H. Wagner and A. W. Böhmisch (*Kolloid-Z.*, 1942, **100**, 263—274; cf. A., 1936, 1459).—The properties of films made by painting emulsions on a glass surface are described and illustrated by photomicrographs. The emulsions studied were of both O/W and W/O types, one component being H_2O and the other linseed oil or a solution (in C_6H_6 , CHCl_3 , etc.) of chlorinated rubber, Bunalite, polystyrene, or a vinyl resin; casein in aq. NH_3 and a sol of Na celluloseglycollate were used as emulsifiers. F. L. U.

Interferometric measurement of film thickness in adsorbed protein monolayers. H. J. Trurnit and G. Bergold (*Kolloid-Z.*, 1942, **100**, 177—191).—Procedure is described. The method, when applied to monolayers of yellow enzyme and of haemocyanin adsorbed on Cr, gives results agreeing with those to be expected from other data, assuming the surface to be completely covered by rectangular prisms the long axes of which are parallel to the surface, and the length of the long axis to be equal to the particle length as determined by other methods. The film thicknesses found for insect virus proteins are consistent with a form factor (long: short axis ratio) of 12, but this cannot be checked by independent data, and the results may be due to failure to form a complete layer. F. L. U.

Diffusion of water in a foil as a cause of an electric current. C. Fischer and F. H. Müller (*Naturwiss.*, 1942, **30**, 604).—Experiments are described which indicate that the diffusion of H_2O through thin films of org. substances (cellulose triacetate and polystyrene) gives rise to an electric current, the variation of which with time has been investigated. A. J. M.

Structure of collodion membrane and its electrical behaviour. V. Influence of thickness of dried collodion membranes on their electromotive behaviour. K. Sollner and C. W. Carr (*J. Gen. Physiol.*, 1943, **26**, 309—323; cf. A., 1943, I, 14).—Determination of the characteristic concn. p.d. across dried collodion membranes of 3—160 μ . thickness, prepared from collodion preps. of different electrochemical activity, shows that the p.d. are a function of the thickness of the membrane. The thinnest membranes always give the lowest concn. p.d.; increase in thickness gives higher p.d. until a const. val. is attained which is characteristic of that particular collodion. With electrochemically active collodion, characteristic concn. p.d. which approach the thermodynamically possible max. are obtained with membranes only 10 μ . thick, whilst thinner membranes give lower vals. The results support the micellar structural theory as applied to dried collodion membranes. J. N. A.

Diffusion of solubilised dyes in water and through membranes. R. B. Dean and J. R. Vinograd (*J. Physical Chem.*, 1942, **46**, 1091—1098).—Measurements of the diffusion const. (D) of Aerosol OT in H_2O and in presence of Yellow AB or Orange OT give no evidence that the presence of the dye lowers D . The dye diffuses as free mols. between the micelles. Diffusion experiments with Cellophane membranes show that solubilised dye and even large micelles of solubilising agent alone cannot, as such, cross the membranes. The solubilising agent has no direct influence on the movement of mols. inside the membrane but it permits diffusion to take place because it maintains a constantly renewed supply of dye mols. close to the membrane on one side and takes up dye mols. on the other side as fast as they diffuse through the membrane. On the basis of these results it is argued that bile salts may not carry fats out of the intestine but only carry fat mols. to the cell membrane so that diffusion can take place. C. R. H.

Descriptions of emulsions. R. H. Marriott (*Chem. and Ind.*, 1943, 123).—The terms "obverse" and "reverse" are proposed for use instead of "oil in water" (O/W) and "water in oil" (W/O), respectively. F. L. U.

Applications of the electron microscope in colloid chemistry. L. Marton (*J. Physical Chem.*, 1942, **46**, 1023—1032).—A review of the basic principles and achievements of the electron microscope. C. R. H.

Thixotropy and dilatancy.—See B., 1943, I, 134.

Sedimentation in angle centrifuge. E. G. Pickels (*J. Gen. Physiol.*, 1943, **26**, 341—360).—Sedimentation of haemocyanin from *Limulus polyphemus* in the angle centrifuge in vac. and in air is determined. Sedimentation in a given field of force is less efficient when determined in air owing to thermal convection. Correlations are established with results obtained in the analytical ultra-centrifuge and a theory of sedimentation in inclined tubes is proposed to explain the results. Under proper conditions the angle centrifuge can be used for approx. determination of particle size. Improvements for securing better sedimentation and interpreting the results are described. To counteract convective disturbances of thermal or inertial origin, the liquid is provided with a synthetic density gradient formed with sucrose or some other non-sedimentable substance. J. N. A.

Vapour pressure and electrodynamic volume of suspensions. H. Lowy (*Phil. Mag.*, 1943, [vii], **34**, 101—104).—The H_2O content of soil and desert sands is discussed in terms of Kelvin's theory for the v.p. over curved liquid surfaces. An extension of the theory, in which the dielectric const. is introduced, suggests an experimental method for determining the relation between v.p. and the curvature of the liquid surface of films for which Kelvin's theory fails. H. J. W.

Highly purified alumina-silica sols. M. E. Schischniashvili and V. A. Kargin (*J. Phys. Chem. Russ.*, 1941, **15**, 1121—1128).—Strongly dialysed mixed sols of Al_2O_3 and SiO_2 show no electrophoretic movement. In the presence of traces of K_2SO_4 , K_3PO_4 , or KNO_3 the cataphoretic mobility is $\sim 2 \times 10^{-4}$ cm./sec./v./cm. These results are of importance for the understanding of the exchange capacity of soils. J. J. B.

Nature of colloidal clay as revealed by the electron microscope. B. T. Shaw (*J. Physical Chem.*, 1942, **46**, 1032—1043).—The results of an electron-micrographical investigation of montmorillonite (I) and kaolinite (II) are discussed. Ultimate dispersion of (I) leads to unit plates $\sim 1 \mu$. thick. Evidence in support of the view that the exchange positions are located on the plate edges of (II) is offered. C. R. H.

Clays as colloidal electrolytes. C. E. Marshall and C. A. Krinbill (*J. Physical Chem.*, 1942, **46**, 1077—1090).—Potentiometric and conductometric measurements show that, for Na^+ , K^+ , and NH_4^+ , ionisation of the clay "salts" follows the order kaolinite (I) > montmorillonite (II) > beidellite (III) > illite (IV) whereas the apparent strengths of the clay acids are in the order (II) > (III) > (IV) > (I). (I) approaches more nearly than the other clays the normal behaviour of a weak acid with extensively dissociated salts. The small metallic cation dissociation of (II), (III), and (IV) may be ascribed to cationic tendency to penetrate some distance into the Si_2O_5 layers, thus partially neutralising the negative charges on the lattice. C. R. H.

Vapour pressure equations of solutions and osmotic pressure of rubber. A. R. Miller (*Proc. Camb. Phil. Soc.*, 1943, **39**, 54—67).—The conception of solute and solvent mols. occupying sites on a regular lattice and potential energy arising from interaction between mols. occupying closest neighbour sites is extended to the derivation of the v.p. equations when each solute mol. consists of three groups or submols. and occupies three closest neighbour sites on the lattice. The results can be generalised for long-chain solute mols. The osmotic pressure $\sim A_1 c(1 + A_2 c)$, where c is the solute concn. in g. per 100 c.c. and A_1 and A_2 determine respectively the mol. wt. and no. of submols. per mol. of the polymeride. L. J. J.

Physical chemistry of resin solutions.—See B., 1943, II, 124.

Theory of molecular size distribution and gel formation in branched-chain polymers. W. H. Stockmayer (*J. Chem. Physics*, 1943, **11**, 45—55; cf. Flory, A., 1942, I, 97, 173).—Mol. size distributions are calc. for certain types of branched-chain high polymers by a mathematical method more general than that of Flory. The work of Flory, which showed that very large polymeric mols. appeared suddenly at a crit. extent of reaction occurring very nearly at the observed gel point, is confirmed. The transition liquid \rightarrow gel is analogous to the condensation of saturated vapour. A. J. M.

Electron-microscopy of cellulose fibres. A. Frey-Wyssling (*Kolloid-Z.*, 1942, **100**, 304—305).—Criticism of a paper by Wergin (A., 1942, I, 391). F. L. U.

Reaction between metal hydroxide solution and cellulose fibres. IV. X-Ray study of lattice changes in fibrous hydrocellulose regenerated from solutions of natural cellulose. W. Schramek and O. Succolowsky (*Kolloid-Z.*, 1942, **100**, 299—303).—The action of aq. NaOH at concns. up to 50% was examined by means of X-ray diagrams. Unlike cotton and ramie, the regenerated cellulose- NaOH system shows a pure heterogeneous reaction-type, and diagrams with mixed patterns are not obtained. The difference is due to the

hindrance to reaction offered by the histological structure of the natural fibres. F. L. U.

Behaviour of cellulose fibres in the electron microscope. A. Hamann (*Kolloid-Z.*, 1942, **100**, 248—254).—A method of preparing very fine fibres (diameter $< 1 \mu$) of regenerated cellulose for electron-microscopical examination is described. With very weak electron radiation it is possible to obtain photographs of the fibres in their natural condition, but on increasing the intensity of the radiation the fibres lengthen, exhibit increasing movement, and become inflated and blistered, until finally the original structure is completely destroyed. The observations of Ruska (*ibid.*, 1940, **92**, 276) are thus seen to be due to the destructive action of the radiation, and the unoriented foam-like structure reported by him is not that of the natural fibres but of their decomp. products. F. L. U.

Action of light on cellulose. Viscosity-concentration relations of cellulose acetate solutions. R. E. Montonna and C. C. Winding (*Ind. Eng. Chem.*, 1943, **35**, 214—216).—Since existing formulæ connecting relative η (η_r) with the vol. of the dispersed phase of colloidal dispersions assume that the dispersed particles are approx. spherical and do not mutually interfere with one another, very dil. solutions must be used in determining data for particles of other shapes. Curves relating the concn. (c) and $(\eta_r - 1)/c$ [= limiting sp. η (L)] at $30 \pm 0.1^\circ$ for dispersions of cellulose acetate (I) in COMe_2 are linear only for $c < 0.5$ g. per 100 c.c.; the deviation from linearity increases with the η of the (I). The curves show that the equation $\eta_r = 1 + ac + bc^2$, which is analogous to the expanded Einstein and Kunitz formulæ, applies to such solutions, and enable a and b to be determined; the inclusion in the equation of a shape-factor, depending on the ratio major:minor axis of the particle, enables the vals. of a and b to be calc. for micellar structures and single, long-chain Staudinger-type macromols. L at infinite dilution may therefore be determined simply by making two η determinations at concns. < 0.5 g. per 100 c.c. L may be correlated with mol. wt. determinations, and used to follow the degradation of cellulose derivatives independently of thixotropic effects and as a general means of characterising (I) solutions. J. G.

Vapour pressure of nitrocellulose gels in acetone. E. Calvet (*Compt. rend.*, 1942, **214**, 767—768).—The mol. concn.-pressure curve for 16.3° shows a marked inflexion at a concn. corresponding with 6 mols. of COMe_2 per C_6 group. Available data for the 40° curve show that the two curves meet at the point of inflexion. The calc. heat of absorption at this point is zero, in agreement with experiment. N. M. B.

Gelatinisation of nitrocelluloses. Heats of absorption of acetone by fibres and films of nitrocellulose. E. Calvet (*Compt. rend.*, 1942, **214**, 716—718).—Heat of absorption curves show marked max. near the absorption of 6 mols. of COMe_2 per C_6 , independent of the no. of NO_2 groups fixed by the cellulose within the range N 11.5—14%. The heats of dissolution are greater for fibres than for films, and for tri- than for di-nitrated cellulose. The heat of absorption of COMe_2 by pure cellulose is approx. the same as for the nitrated forms. Explanations are discussed. N. M. B.

Diffusion velocity of ovalbumin in relation to its mol. wt. L. Friedman and B. R. Ray (*J. Physical Chem.*, 1942, **46**, 1140—1150).—The diffusion coeff. of ovalbumin (I) at 4° from 0.2% solution has been measured. From these and η and d data the radii, mol. wt., dissymmetry const., ratio of axes, and the possible extent of the (I) mol. being hydrated have been calc. The vals. obtained differ considerably according to the equation used in calculation, e.g., mol. wt. 30,600—111,900 and dissymmetry const. 1.96—8.37. C. R. H.

Acid-base-binding capacity of collagen. E. R. Theis and T. F. Jacoby (*J. Biol. Chem.*, 1942, **146**, 163—169).—A method for determining the H^+ - and OH^- -binding capacity of collagen has been developed. The collagen material is equilibrated in contact with aq. HCl or KOH of known pH val., pressed to remove unbound electrolyte, air-dried, and ground. The ground material (0.5 g.) is treated with H_2O (50 c.c.) and 0.1N- HCl (10 c.c.) for 2 hr., after which 10 c.c. of KI-KIO_3 reagent (KI 200 g., KIO_3 50 g. per l.) and 20 c.c. of 0.1N- $\text{Na}_2\text{S}_2\text{O}_3$ are added and allowed to react during 2 hr. The excess of $\text{Na}_2\text{S}_2\text{O}_3$ is titrated with 0.1N- HCl or -I and the H^+ or OH^- fixed per g. of protein is deduced from the 0.1N- $\text{Na}_2\text{S}_2\text{O}_3$ consumed. The results are in accord with other analytical data. J. W. S.

Electrophoretic patterns, colloid osmotic pressure, and viscosity of serum denatured by ultra-violet radiation.—See A., 1943, III, 271.

Coagulation of hydrophobic sols by electrolyte mixtures. V. Coagulation of negative silver iodide sol by ions (Hg^{++}) reacting with the micelle. L. Lepin and A. Bromberg (*J. Phys. Chem. Russ.*, 1941, **15**, 673—685).— $\text{Hg}(\text{NO}_3)_2$ forms with AgI sol stabilised by I^- ions first Ag_2HgI_4 and then HgI_2 (both detected spectroscopically). The coagulating concn. C of $\text{Hg}(\text{NO}_3)_2$ is independent of the concn. of KNO_3 or K_2SO_4 but is $= 0.5[\text{I}^-]$, when $[\text{I}^-]$ is varied by addition of KI . At a const. $[\text{KI}]$ C increases when $[\text{AgI}]$ increases. The coagulation takes place when all the surplus I^- ions are transformed into either HgI_4^{--} or HgI_2 . J. J. B.

Mutual coagulation of colloidal solutions. V. Effect of dilution on the mutual coagulation of colloidal solutions of ferric hydroxide and thorium hydroxide by Prussian-blue. P. M. Barve, R. B. Naimpally, and B. N. Desai (*J. Univ. Bombay*, 1942, **11**, A, Part 3, 78—84).—No definite relationship exists between the charge on either positively charged $\text{Fe}(\text{OH})_3$ or $\text{Th}(\text{OH})_4$ when coagulated by negatively charged Prussian-blue, and the width of the zone of mutual coagulation. F. R. G.

Electrophoretic mobilities of deoxyribose- and ribose-nucleic acids. S. S. Cohen (*J. Biol. Chem.*, 1942, **146**, 471—473).—The method of prep. of a nucleic acid affects its electrophoretic mobility and hence its electric charge. Deoxyribose- and ribose-nucleic acid possess similar or different charges depending on the method of isolation. J. E. P.

Theory and application of a two-path rectangular microelectrophoresis cell. H. Beniams and R. G. Gustavson (*J. Physical Chem.*, 1942, **46**, 1015—1023).—The theory of the rectangular two-path microelectrophoresis cell and its construction are discussed. In accuracy, adaptability, and speed it compares favourably with the usual single-path cell. C. R. H.

Relation between ζ -potential and the electrical capacity of the double layer. W. G. Eversole and C. H. Estee (*J. Chem. Physics*, 1943, **11**, 63—66).—Errors in the usual calculation of the electrical capacity of the double layer from ζ -potentials are pointed out, and an equation is deduced which makes allowance for the distribution of charge on both sides of the ζ -potential plane. The capacity of a glass surface in contact with dil. aq. solutions of LiCl , KCl , and CsCl is calc. from ζ -potentials. The vals. vary from $1 \mu\text{F. per cm.}^2$ at 10^{-6}M. to about $25 \mu\text{F. per cm.}^2$ at M. concn. The connexion with electro-capillary phenomena is considered. A. J. M.

VI.—KINETIC THEORY. THERMODYNAMICS.

Determination of equilibrium and reaction velocity in sulphur vapour by quenching experiments. H. Braune and S. Peter (*Naturwiss.*, 1942, **30**, 607—608).—The amount of S_μ in S vapour has been determined at different temp., the results being in general agreement with those of Preuner (A., 1910, ii, 118). The dependence of the S_μ content on the partial pressure of S vapour agrees with the expected val. The S_μ content of the condensed vapour corresponds with the S_μ content of the vapour itself. The velocity of attainment of equilibrium was also investigated. A. J. M.

$\text{Cr}^{\text{III}}/\text{Cr}^{\text{VI}}$ indicator in the investigation of borate melts. H. Lux and E. Rogler (*Z. anorg. Chem.*, 1942, **250**, 159—172).—The colour change of $\text{Cr}^{\text{III}}/\text{Cr}^{\text{VI}}$ indicator has been used to investigate the O'' activity in $\text{Na}_2\text{O-B}_2\text{O}_3\text{-M}_2\text{O}_3$ melts ($\text{M} = \text{K, Li, Pb, Ba, Mg, Be, La, Al, Si, or P}$) at 1100° . B_2O_3 behaves as a weak acid but the presence of strongly polarisable bi- and ter-valent cations increases its acidic character and renders the metaborate stage more stable. PbO , BaO , and La_2O_3 are particularly effective in this. C. R. H.

Ionisation constant of morpholine in water. A. R. Ingram and W. F. Luder (*J. Amer. Chem. Soc.*, 1942, **64**, 3043—3044).—The ionisation const. of morpholine in H_2O at 25° from A measurements is 2.44×10^{-6} . W. R. A.

Thermodynamic properties of solutions of amino-acids and related substances. VIII. Ionisation of glycylglycine, ϵ -aminohexanoic acid, and aspartic acid in aqueous solution at $1\text{--}50^\circ$. E. R. B. Smith and P. K. Smith (*J. Biol. Chem.*, 1942, **146**, 187—195).—The two dissociation consts. of glycylglycine and ϵ -aminohexanoic acid and the three dissociation consts. of aspartic acid have been determined at 1.0° , 12.5° , 25.0° , 37.5° , and 50° and the free energy, enthalpy, and entropy changes accompanying the ionisation are deduced. J. W. S.

Mean activity of solutions of thallous azide. (Mme.) M. L. Brouty (*Compt. rend.*, 1942, **214**, 258—261).—E.m.f. measurements for a cell containing various concns. of TlN_3 are described. The normal potential calc. by La Mer's method is $(6298 \pm 1) \times 10^{-4}$ v., and data for e.m.f. and the activity coeffs. corresponding with each concn. are tabulated. N. M. B.

Temperature coefficients of hydrogen-ion concentration in blood and other buffers.—See A., 1943, III, 271.

Liquid-vapour equilibrium compositions in the hydrogen chloride- n -butane system. J. H. Ottenweller, C. Holloway, jun., and W. Weinrich (*Ind. Eng. Chem.*, 1943, **35**, 207—209).—Data are recorded for compositions of equilibrium vapour-liquid phases in $\text{HCl-n-C}_4\text{H}_{10}$ systems at 70° , 120° , and 180°F. , at pressures < 550 lb. per in.² The bubble-point curves give an approx. linear relation between mol.-% HCl and pressure. L. J. J.

Vapour-liquid equilibria for commercially important systems of organic solvents. Binary systems ethanol- n -butanol, acetone-water, and isopropanol-water. A. S. Brunjes and M. J. P. Bogart (*Ind. Eng. Chem.*, 1943, **35**, 255—260).—Vapour-liquid equilibrium data for $\text{EtOH-Bu}^\circ\text{OH}$, $\text{COMe}_2\text{-H}_2\text{O}$, and $\text{Pr}^\circ\text{OH-H}_2\text{O}$, and activity coeffs. for the two latter systems, have been determined. L. J. J.

Pure hydrocarbons from petroleum. Vapour-liquid equilibrium of methylcyclopentane-benzene and other binary aromatic systems. J. Griswold and E. E. Ludwig (*Ind. Eng. Chem.*, 1943, 35, 117—119).—Data for the methylcyclopentane (I)— C_6H_6 system indicate a min.-boiling azeotropic mixture, b.p. 71.5° , containing ~ 90 mol.-% of (I). The influence of aromatics on fractionation is discussed. C_6H_6 , through its tendency to form azeotropes, prevents complete resolution of C_6 fractions by distillation, whilst PhMe, although it does not form azeotropes, exhibits abnormally low relative volatility in certain mixtures and for this reason its presence increases the difficulty of but does not prevent complete resolution. C. R. H.

Heterogeneous equilibria in aqueous solutions of the sulphates of quadrivalent vanadium at 30° . C. S. Rohrer, O. E. Lanford, and S. J. Kiehl (*J. Amer. Chem. Soc.*, 1942, 64, 2810—2816).—Solubility measurements are given for the system $VO_2 \cdot SO_3 \cdot H_2O$ at 30° , $VO_2 \cdot H_2O$, $VO_2 \cdot SO_3 \cdot 5H_2O$, $VO_2 \cdot SO_3 \cdot 3H_2O$, $2VO_2 \cdot 3SO_3 \cdot 4H_2O$, and $VO_2 \cdot SO_3$ exist as stable solid phases. Other reported compounds could not be detected. $VO_2 \cdot SO_3$ exists in a form, not previously reported, sol. in H_2O . W. R. A.

Isotherms of the system sodium chromate-sodium chlorate-water. J. E. Ricci and C. Weltman (*J. Amer. Chem. Soc.*, 1942, 64, 2746—2748).—Solubility determinations on the system Na_2CrO_4 — $NaClO_3$ — H_2O at 19° , 25° , and 50° give no evidence of formation of compounds or solid solutions by the two salts. W. R. A.

Equilibrium relationships on liquidus surface in part of MnO — Al_2O_3 — SiO_2 system. R. B. Snow (*J. Amer. Ceram. Soc.*, 1943, 26, 11—20).—Minerals with a stability range in this system are cristobalite, tridymite, $3Al_2O_3 \cdot 2SiO_2$, corundum, $MnO \cdot SiO_2$, $2MnO \cdot SiO_2$ (I), $MnO \cdot Al_2O_3$, $3MnO \cdot Al_2O_3 \cdot 3SiO_2$ (II) (identical with the garnet spessartite), and $2MnO \cdot 2Al_2O_3 \cdot 5SiO_2$ (III), the basic structure of which is similar to that of cordierite, $MgO \cdot 2Al_2O_3 \cdot 5SiO_2$. (III) seldom crystallises from the glass, but, on reheating the glass, high-extinction angle crystals readily form which in turn are replaced by (III) under suitable heat-treatment. Quintuple points and boundary lines of the field within the limits (II)— SiO_2 , (II)— Al_2O_3 , and Al_2O_3 — SiO_2 have been determined and those within the field (I)—(II), (II)— SiO_2 , and (I)— SiO_2 are indicated. J. A. S.

Polytherm of the ternary system H_2O — KCl — KBr . A. G. Bergman and N. A. Vlasov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 36, 57—61).—The system H_2O — KCl — KBr has been studied at $> 30^\circ$. The only solid phases formed are ice and KCl — KBr solid solutions. The eutectic point is at -13.4° and KCl 6.6%, KBr 25.6%. J. W. S.

Mixed bismuth oxyiodides. L. G. Sillén and E. Jörnstad (*Z. anorg. Chem.*, 1942, 250, 173—198).—The systems Ba — Bi — O — I , Sr — Bi — O — I , and Cd — Bi — O — I have been investigated by means of X-ray analysis in order to determine the presence of oxyiodide structures. A detailed analysis of the respective lattice structures is given. Two phases of definite composition are reported, viz., $SrBi_2O_4I_2$, a space-centred tetragonal structure with a 4.035, c 31.89 Å, and $CdBi_2O_4I_2$ with a 3.970, c 13.24 Å. C. R. H.

Thermodynamical calculation of quaternary systems. System o -xylene, m -xylene, p -xylene, ethylbenzene. V. M. Kravtschenko (*J. Phys. Chem. Russ.*, 1941, 15, 652—658).—Assuming the system to have an ideal solubility, the eutectic temp. and compositions are calc. The quaternary eutectic melts at -101.3° . J. J. B.

Quaternary system of sodium, potassium, calcium, and magnesium nitrates and the component systems. E. Jänecke (*Z. Elektrochem.*, 1942, 48, 453—467).—The binary, ternary, and quaternary systems have been investigated over the complete composition range. The only compound definitely confirmed is $(KNO_3)_2 \cdot Mg(NO_3)_2$. J. W. S.

Heat of formation of stannous chloride and of displacement of tin by zinc, and entropy of tin ion. A. F. Kapustinski (*J. Phys. Chem. Russ.*, 1941, 15, 645—651).—The heat of reaction Zn (solid) + $Sn^{2+} = Zn^{2+} + Sn$ (solid) at 25° is -30.9 kg.-cal. This gives for the heat of formation of solid $SnCl_2$ from solid Sn and Cl_2 gas -83.6 kg.-cal. and for the entropy of Sn^{2+} -15.2 g.-cal. per degree. J. J. B.

Heats of combustion. II. Heats of combustion of methyl ethyl ketone and ethylene oxide. R. S. Crog and H. Hunt (*J. Physical Chem.*, 1942, 46, 1162—1163).—The heats of combustion of liquid COMeEt and gaseous $(CH_3)_2O$ are 582.28 ± 0.37 and 312.55 ± 0.20 kg.-cal. per mol. respectively. C. R. H.

Orange-red and grey-black antimony trisulphide. R. Fricke and E. Dönges (*Z. anorg. Chem.*, 1942, 250, 202—203).—The heats of dissolution in $0.75N$ - Na_2S of cryst. grey-black and amorphous orange-red Sb_2S_3 are 18.54 and 26.07 kg.-cal. per g.-mol., respectively, indicating 7.53 kg.-cal. per g.-mol. as the heat of crystallisation. C. R. H.

New method of determining the heat of sorption. A. V. Likov and M. Z. Brenner (*J. Phys. Chem. Russ.*, 1941, 15, 1129—1136).—Heat (H) of sorption is measured by observing the rapid increase and slow decrease of the temp. of the sorbent during the sorption. Experiments on dry leather and H_2O vapour show that H is $<$ the

latent heat of condensation of H_2O . If moist leather is used, H is smaller still. J. J. B.

Calculation of free energies, entropies, specific heats, and equilibria from spectroscopic data and the validity of the third law of thermodynamics. V. Advances in the period 1935—1940. H. Zeise (*Z. Elektrochem.*, 1942, 48, 476—509). A review. J. W. S.

Nature of entropy. (A) I. D. Campbell (B) H. S. Allen (*Nature*, 1943, 151, 138—139, 225—226).—(A) If the temp. scale were designed so that temp. \propto (heat energy) $^{1/2}$, entropy would, in a simple heat transfer, bear a straight-line relationship to temp., mean mol. velocity would be \propto temp., and equal increments of temp. would represent a greater increment of energy at high than at low temp. (B) A criticism. A. A. E.

VII.—ELECTROCHEMISTRY.

Electrical conductivity of sodium and potassium guaiacoxides in guaiacol. T. Shedlovsky (*J. Gen. Physiol.*, 1943, 26, 287—292).—The data of Shedlovsky and Uhlig (A., 1934, 491) and new data on the conductivity of Na and K guaiacoxides in guaiacol at 25° have been computed by means of an improved conductance equation which is valid for higher concn. than are the equations formerly used. The new consts. are $\Lambda_0 = 9.0$ and $K = 2.8 \times 10^{-5}$ for Na and $\Lambda_0 = 9.5$ and $K = 3.4 \times 10^{-5}$ for K guaiacoxide respectively. J. N. A.

Change in potential of silver-silver chloride electrodes with time. E. R. Smith and J. K. Taylor (*J. Amer. Chem. Soc.*, 1942, 64, 3053).—A reply to criticisms by Hornibrook, Janz, and Gordon (A., 1942, I, 239). W. R. A.

Irreversible electrode potentials of tin. A. J. Schatalov (*J. Phys. Chem. Russ.*, 1941, 15, 401—409).—The potentials of Sn in solutions of KCl , $NaCl$, NH_4Cl , $BaCl_2$, HCl , KBr , KI , KNO_3 , Na_2SO_4 , and $NaOH$ assume nearly const. vals. after some hr. or days of immersion. The pretreatment of the electrode affects the potential for only ~ 1 hr. The corrosion of Sn in $4N$ - NH_4Cl is $>$ that in $0.25N$ - NH_4Cl . Oxide films retard the corrosion. J. J. B.

Potential of silver concentration cells with liquids of low dielectric constant. A. Gemant (*J. Chem. Physics*, 1942, 10, 723—730).—E.m.f. and conductivity measurements in concn. cells with Ag and Ag-AgCl electrodes in solutions of electrolytes (e.g., $LiCl$, NEt_4Cl , NBu_4Cl , Ag picrate, $AgNO_3$) in solvents of low ϵ (< 2.6), e.g., dioxan and xylene with small admixtures of H_2O and EtOH, are described. Measurements are possible with κ as low as 10^{-11} mho per cm. Vals. of transport nos. and dissociation consts. are deduced. The ions appear to be of mol. size. L. J. J.

Electromotive force of the mercurous bromide electrode. W. R. Crowell, R. W. Mertes, and S. S. Burke (*J. Amer. Chem. Soc.*, 1942, 64, 3021—3023).—At 25° in $0.1002M$ -HBr the vals. for molal reduction e.m.f. in solutions free from air are ~ 0.5 mv. $>$ those for solutions from which air has not been completely removed. E.m.f. measurements at 25° and 35° in N -, $2N$ -, and $3N$ -HBr are given. W. R. A.

Effect of temperature on potential of glass electrodes for pH determination. E. Wengel and N. Schrodtt (*Naturwiss.*, 1942, 30, 567—568).—The effect of temp. on the potential of glass electrodes made of Schott Jena glass 4073 III (~ 2 megohms resistance) and a low-resistance glass (~ 0.2 megohm) is linear. A. J. M.

Salt error of the quinhydrone electrode in aqueous nitric acid, and potentials of the hydro-quinhydrone and quino-quinhydrone electrodes. H. I. Stonehill (*Trans. Faraday Soc.*, 1943, 39, 67—72).—The salt error is determined by measuring the e.m.f. of the cells $Pt(Au)|quinhydrone, HNO_3(c)|HNO_3(c), quinhydrone, quinol$ or $quinone|Pt(Au)$, the solutions being saturated with respect to the org. substances; the method depends on the absence of salt error in the hydro-quinhydrone and quino-quinhydrone electrodes. The average error $\Delta E_{KNO_3} = -0.0053c$ v. By using a glass electrode the salt error in aq. KNO_3 is found to be $\Delta E_{KNO_3} = -0.0038c$ v. Salt errors in mixed HCl and KNO_3 solutions are additive. The standard potentials of the hydro-quinhydrone and quino-quinhydrone electrodes at 25° are 0.6141 and 0.7459 v., respectively. F. L. U.

Thallous-thallic redox potential in nitric and perchloric acids. H. I. Stonehill (*Trans. Faraday Soc.*, 1943, 39, 72—79).—The potentials are obtained by using the two cells $Pt|TlA(c_1), TlA_3(c_2), HA(c)|HA(c), quinhydrone|Pt$, where A represents ClO_4 and NO_3 in the respective cells. The liquid junction potential is eliminated by measuring the e.m.f. for each acid concn. with progressively decreasing Tl content, the ratio c_2/c_1 being maintained const., and extrapolating to $[Tl] = 0$, when the liquid contact potential vanishes. The results agree fairly with those obtained by Sherrill and Haas for $HClO_4$ (A., 1936, 938) and by Noyes and Garner for HNO_3 (*ibid.*, 1072), both of which are affected by uncertainties due to liquid junction potentials. The true standard redox potential is estimated to have the same val., 1.280 v., in both $HClO_4$ and HNO_3 . F. L. U.

Temperature correction devices in ion concentration measurements. F. Lieneweg (*Z. tech. Physik*, 1942, 23, 217).—A correction (cf. A., 1943, I, 63). A. J. E. W.

Cathodic processes at an iron electrode under conditions of corrosion with oxygen depolarisation. N. D. Tomaschov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 203—205).—Cathodic polarisation curves on Fe surfaces supplied with O_2 in a bath at $pH \sim 9$, show 3 sections corresponding with (1) $O_2 + 4e + 2H_2O \rightarrow 4OH^-$ up to c.d. ~ 1 mA. per sq. cm., (2) control of cathode reaction velocity by diffusion, up to -0.6 v., (3) discharge of H^+ above -0.6 v. An oxidised Fe cathode is less effective than a clean one. Fe_3O_4 is reduced when the potential is < -0.5 v. No H_2O_2 is formed. L. J. J.

Activity-waves in passive iron wires. K. F. Bonhoeffer and W. Renneberg (*Z. Physik*, 1941, 118, 389—400).—For passive piano-wire immersed in HNO_3 of ρ 1.315—1.375, in glass tubes of varying diameter, the velocity (v) of activity-waves can be calc. from a knowledge of the surface potential distribution in the wave and the min. electrical impulse (ϵ) required for activation. The movement of the active zone is determined by spontaneous surface potential changes. The val. of ϵ depends on the time (t) elapsed since a previous activation, with a min. val. for $t \sim 15$ min., and increases with $[HNO_3]$ from ~ 110 μ -coulomb per sq. cm. at ρ 1.24 to ~ 230 μ -coulomb per sq. cm. at ρ 1.40. Oscillographic wave potential profiles are recorded. L. J. J.

Hydrogen overvoltage and dissolution of metals. I. Dissolution of lead in acids. J. Kolotirkin and A. Frumkin (*J. Phys. Chem. Russ.*, 1941, 15, 346—358).—The rate v of H_2 evolution by spongy Pb in 3N-HCl or 8N- H_2SO_4 is determined by the equilibrium potential of Pb and the overvoltage η corresponding with this potential. If the spongy Pb is made a cathode and the straight line $\log_e v - \eta$ determined, it joins the point representing the v in the absence of external current. At small c.d. ($< 3 \times 10^{-8}$ amp. per sq. cm.) v is $<$ equiv. to the external current as the latter is used up for reduction of O_2 at the cathode. The equilibrium potential of Pb in 8N- H_2SO_4 is that of the electrode $Pb|PbSO_4|8N-H_2SO_4$. J. J. B.

Polarography of solutions of polymetaphosphates. I. V. Caglioti, G. Sartori, and E. Bianchi (*Gazzetta*, 1942, 72, 63—68).—Polarography of aq. $Na_3P_3O_9 \cdot 6H_2O$ (I) in presence of $ZnCl_2$, $FeSO_4$, $MnCl_2$, $CdCl_2$, $Pb(NO_3)_2$, and $CuSO_4$ shows that Cu^{++} and Cd^{++} do not form complexes, Zn^{++} , Mn^{++} , and Pb^{++} form unstable complexes, and Fe^{++} a more stable complex, with (I). E. W. W.

Polarography of organometallic compounds. I. L. Riccoboni (*Gazzetta*, 1942, 72, 47—62).—Polarograms of $PbEt_3Cl$ (I) in N-KCl containing a trace of fuchsin are compared with those of $PbCl_2$, and the results discussed mathematically. The cathodic reduction of (I) is univalent; the mean potential ($E_{1/2}$) is -0.723 v. (to N-HgCl electrode), -0.473 v. (to Pb^{++} at 13°). The val. -0.473 v. (20°) for $E_{1/2}$ for Pb^{++} is confirmed. Measurements relative to Pb^{++} must take account of the association of this ion in solution. The method of calculating the activity coeff. γ_{PbCl} for solutions containing varying quantities of $PbCl_2$ and KCl is discussed; γ_{PbCl} is used (cf. Lingane, A., 1939, I, 525) to derive the product of the kinetic consts. as a function of electrolytic potential. Assuming that $PbCl = TlCl$ in reticular energy, the heat of formation of $PbCl$ is calc. as 13 kg.-cal. The thermochemistry of $PbEt_3$ is discussed. E. W. W.

Theory of metal corrosion. I. Distribution of the lines of current and potential in corrosion micro-cells. V. S. Daniel-Bek (*J. Phys. Chem. Russ.*, 1941, 15, 382—400).—The surface of a dissolving metal, at a first approximation, equiv. to a system of two electrodes, a metal resistance, and three electrolyte resistances; more complicated models represent metals which dissolve in acids and are subject to an anodic or cathodic polarisation. If the potentials of the micro-anode and the micro-cathode are linear functions of the polarising current i , the reduction of the H_2 evolution caused by the polarisation is $\propto i$. A second approximation takes into account the variation of the potentials of the micro-anodes and the micro-cathodes caused by their polarisation by the micro-current itself. This polarisation is measured on a large-scale model (an electrode consisting of regularly arranged strips of Zn and Cu in N-HCl). The measurable potential of a mixed electrode is that of the boundaries between Zn and Cu patches. J. J. B.

VIII.—REACTIONS.

Stability and structure of burner flames. B. Lewis and G. von Elbe (*J. Chem. Physics*, 1943, 11, 75—97).—The gas-flow pattern was investigated by photographing stroboscopically illuminated dust particles carried by the gas stream. The conditions for the stability of the flame above the orifice have been investigated for upright and inverted flames. Gas and burning velocities are equal near the rim of the orifice or an obstruction in the gas stream, equality being maintained by friction effects. There are two crit. gradients of gas velocity at the solid surface, the lower being near the flash-back, and the upper near the blow-off range. Vals. for these gradients in the range of laminar flow are calc. and it is shown experimentally that they are independent of tube diameter except

where this is very large. The effect of the surrounding atm. on the crit. blow-off gradient is shown. The burning velocity is const. over the surface of the inner cone of the flame except at the tip, where it increases to the axial gas velocity, and at the base, where it is zero. The temp. of the flame was determined by the Na line reversal method. The emission spectra of the flames were determined. The connexion between temp. distribution and flow pattern has been examined. An explanation of polyhedral flame cones is given. A. J. M.

Calculation of velocity of oxidation of nitric oxide to nitrogen peroxide with simultaneous absorption of the $NO \cdot NO_2$ formed in an absorbent.—See B., 1943, I, 153.

Tracer studies with radioactive carbon. Exchange between acetic anhydride and sodium acetate. S. Ruben, M. B. Allen, and P. Nahinsky (*J. Amer. Chem. Soc.*, 1942, 64, 3050).—The exchange between MeC^*O_2Na and Ac_2O at room temp. within 20 min. is $\sim 55\%$. W. R. A.

Steric hindrance to ketonic function. I. Velocity of formation of oximes of cyclohexanone and its derivatives. A. R. Poggi and A. Carrara (*Gazzetta*, 1942, 72, 3—15).—The following methods of determining velocity of oxime-formation are compared experimentally, using cyclohexanone and its 2-, 3-, and 4-Me derivatives: (a) NaOH titration of HCl liberated from $NH_2OH \cdot HCl$, using methyl-orange (cf. Brochet, Thesis, Nancy, 1923), or (b) using $p-C_6H_4Br \cdot OH$ -blue (II) (cf. Anziani, Thesis, Nancy, 1927); (c) H_2SO_4 titration of free NH_2OH (Anziani, *ibid.*) (method modified), using (II); and (d) I titration of NH_2OH (cf. Ruzicka *et al.*, A., 1932, 253). The best method is (b) (modified), although HCl liberated has catalytic action; this is absent in (d), which, however, gives somewhat variable results. (I) is less reactive than the other ketones studied. E. W. W.

Polarography of pyocyanine. C. Cattaneo and G. Sartori (*Gazzetta*, 1942, 72, 38—41).—The reduction of pyocyanine (cf. Elema, A., 1931, 1013) is shown polarographically to be of second order (0.058 v.) from pH 5 to pH 8.71, but of first order below pH 5, when the semiquinone (cf. Kuhn *et al.*, A., 1935, 1255) is intermediately formed. E. W. W.

Causes of the diversity in acid hydrolyses of starch substances.—See A., 1943, II, 124.

Rates of high-temperature oxidation of dilute copper alloys.—See B., 1943, I, 169.

Catalytic decomposition of potassium chlorate. I, II. G. B. Kolhatkar and U. A. Sant (*J. Univ. Bombay*, 1942, 11, A, Part 3, 96—100).—I. Decomp. of $KClO_3$ is catalysed in diminishing order by Co_2O_3 , Cr_2O_3 , MnO_2 , Fe_2O_3 , Ni_2O_3 , and CuO .

II. Catalytic decomp. is effected by VCl_4 , $Ti(SO_4)_2$, $Cr_2(SO_4)_3$, $MnSO_4$, $FeSO_4$, $CoSO_4$, $NiSO_4$, and $CuSO_4$. F. R. G.

Reaction velocity with colloidal catalysts. P. Harteck and H. Jensen (*Z. Physik*, 1941, 118, 416—423).—Expressions are developed for effect of diffusion and catalytic activity on the rate of a reaction between a gas and a liquid, catalysed at the surface of solid spheres suspended in the liquid. The relation between the temp. coeff. of reaction rate and the catalytic activity and activation energy of the reaction is discussed. L. J. J.

Chemisorption of oxygen on charcoal. B. K. Trivedi (*J. Univ. Bombay*, 1942, 11, A, Part 3, 185—186).—NO at low temp. with charcoal starts and catalyses the auto-oxidation of NO, yielding N_2 together with NO_2 condensed on the charcoal, which produces chemisorbed O_2 and hence CO_2 and N_2 . The reaction of sugar charcoal with O_2 and NO_2 has also been investigated at $0-300^\circ$. F. R. G.

Mixed heteropoly-acid catalysts for the vapour-phase air-oxidation of naphthalene. H. T. Brown and J. C. W. Frazer (*J. Amer. Chem. Soc.*, 1942, 64, 2917—2920).—Catalysts prepared from heteropoly-acid crystals containing W and Mo have been used in the oxidation of $C_{10}H_8$. The catalyst (I) from $H_4SiMo_3W_3O_{40}$ gave greater conversion into $o-C_8H_4(CO_2)_2O$ (II) than $H_4SiMo_{12}O_{40}$ or $H_4SiW_{12}O_{40}$. Addition of CO_2 increased the yield of (II) but decreased the yield of maleic anhydride. (I) has also been employed in the oxidation of (II), 1:4-naphthaquinone, and CO. W. R. A.

Catalytic interchange of groups in aliphatic amines. I. K. Nozaki (*J. Amer. Chem. Soc.*, 1942, 64, 2920—2923).—The redistribution of groups attached to N when aliphatic amines are heated with metal halide catalysts has been studied, particularly with regard to the action of $AlCl_3$, $FeCl_3$, and $ZnCl_2$ on $NHBu_2$. W. R. A.

Relation of electrochemistry to aluminium and aluminium alloys. I—III.—See B., 1943, I, 173.

Indium plating.—See B., 1943, I, 172.

Chemistry of chromic acid anodic baths [for aluminium] and its application to bath control.—See B., 1943, I, 172.

Heavy nickel-plating.—See B., 1943, I, 171.

Use of palladium in electroplating.—See B., 1943, I, 171.

Photochemistry of mixtures of hydrogen and chlorine through a century. M. Bodenstein (*Ber.*, 1942, 75 [A], 119—136).—A lecture. H. W.

Photochemical boundary surface action. G. M. Schwab and A. Issidoridis (*Ber.*, 1942, 75 [B], 1048—1051).—Layers of CO_2 , NO_2 , adsorbed on Al_2O_3 or ZnO are coloured brown-green in bright sunlight but no change is observed unless the solution is alkaline or when it is in contact with powdered glass, MgO , SnO_2 , SiO_2 , or CdCO_3 . The representation of the reaction by the equation $4\text{CO}_2 + 8\text{OH}^- \xrightarrow{h\nu} \text{U}_3\text{O}_8 \cdot 2\text{H}_2\text{O} + \text{UO}_4 \cdot 2\text{H}_2\text{O}$ is justified by the detection, after addition of acid, of H_2O_2 by the perchromic acid reaction and by use of $\text{Ce}(\text{OH})_3$. H. W.

Winther's photochemical storage cell. G. Liandrat and A. Sator (*Compt. rend.*, 1942, 214, 733—739).—An electrochemical explanation of the partial conversion of a solution of HgCl_2 and FeCl_2 into HgCl_2 and FeCl_3 is given, the oxidation-reduction ionic equilibrium being disturbed. J. L. E.

Mechanism of photolysis of propaldehyde. W. M. Garrison and M. Burton (*J. Chem. Physics*, 1942, 10, 730—739).—In the photolysis of EtCHO at $\lambda\lambda$ 2537, ~ 2900 , and ~ 3200 Å, Et radicals, but not H atoms, can be detected by the Paneth mirror method. The ratio $\text{C}_2\text{H}_5 : \text{CO}$ formed is 0.3—0.5. Two primary decomp. reactions are involved; one producing $\text{Et} + \text{CHO}$ preponderates at short $\lambda\lambda$, the other producing $\text{C}_2\text{H}_5 + \text{CO}$ at longer $\lambda\lambda$. L. J. J.

Reversible photochemical processes in rigid media. Dissociation of organic molecules into radicals and ions. G. N. Lewis and D. Lipkin (*J. Amer. Chem. Soc.*, 1942, 64, 2801—2808).—Illumination of N_2Ph_4 in rigid solvents by ultra-violet radiation leads to the solution becoming coloured and exhibiting three main absorption bands due to NPh_3 , NPh_3^+ , and N_2Ph_4^+ . N_2Ph_4^+ disappears by two processes: return of the electron or dissociation into NPh_3 and NPh_3^+ . Similar experiments on various substances indicate that a mol. may be dissociated by light into (i) two radicals, (ii) positive and negative ions, or (iii) a positive ion and an electron. W. R. A.

IX.—PREPARATION OF INORGANIC SUBSTANCES.

Mechanism of the action of charcoal on potassium nitrate. I. Effect of the temperature, time, etc. T. M. Oza and M. S. Shah (*J. Univ. Bombay*, 1942, 11, A, Part 3, 56—69).— KNO_3 reacts with charcoal at 250° resulting in the intermediate formation of KNO_2 according to the equations $4\text{KNO}_3 + 2\text{C} = 4\text{KNO}_2 + 2\text{CO}_2$ and $4\text{KNO}_2 + 3\text{C} = 2\text{K}_2\text{CO}_3 + \text{CO}_2 + 2\text{N}_2$, the latter representing the net result of several reactions. F. R. G.

Thermal decomposition of potassium nitrite. T. M. Oza and M. S. Shah (*J. Univ. Bombay*, 1942, 11, A, Part 3, 70—77).—The primary decomp. at 440—540° is considered to be $2\text{KNO}_2 = \text{K}_2\text{O} + \text{NO} + \text{NO}_2$. The amounts of NO_2 are \ll of NO , due to the reactions $4\text{KNO}_2 + 2\text{NO}_2 = 4\text{KNO}_3 + \text{N}_2$ and $\text{KNO}_2 + \text{NO}_2 = \text{KNO}_3 + \text{NO}$, finally $\text{KNO}_3 = 2\text{KNO}_2 + \text{O}_2$. F. R. G.

Cuprous cyanide. Preparation and use. H. J. Barber (*J.C.S.*, 1943, 79).— CuCN is prepared by adding a solution of NaHSO_3 (280 g. in 800 c.c. of H_2O) to CuSO_4 (1 kg. in 3.2 l. of H_2O) followed by KCN (280 g. in 800 c.c. of H_2O), all solutions being at 60°. The hot solution is filtered and the ppt. is washed with hot H_2O and EtOH and dried at 100°. C. R. H.

Basic copper selenates. A. Baroni (*Gazzetta*, 1942, 72, 19—22).—The system $\text{Cu}(\text{OH})_2 + \text{CuSeO}_4 + \text{H}_2\text{O}$ at 30° gives as solid phase (Schreinemaker's method) a compound (I), $\text{SeO}_3 \cdot 4\text{CuO} \cdot 4\text{H}_2\text{O}$, which at 150° gives a compound, $\text{SeO}_3 \cdot 4\text{CuO} \cdot 3\text{H}_2\text{O}$. At 100°, (I) and a compound, $\text{SeO}_3 \cdot 3\text{CuO} \cdot 2\text{H}_2\text{O}$, are formed. E. W. W.

Electron beam study of membranes formed by action of ammonia or potassium hydroxide on solutions of copper salts. A. Baroni and G. B. Marini-Bettolo (*Gazzetta*, 1942, 72, 22—27).—The membrane formed by action of NH_3 and air on 1% aq. CuSO_4 is shown by electron beam photogram to be feebly cryst. on formation, and later to develop more definitely cryst. character. Results at 20—70° are similar, indicating the formation of a single basic sulphate. The product from aq. KOH is at first amorphous, then cryst. $\text{Cu}(\text{NO}_3)_2$ and NH_3 give a const. type of photogram. CuCl_2 gives similar results with NH_3 and KOH , indicating the formation of a single basic salt. $(\text{HCO}_3)_2\text{Cu}$ gives no membrane; other org. salts give basic salts. Photograms of $\text{Cu}(\text{OH})_2$ prepared in various ways are discussed. E. W. W.

Reduction of silver oxalate. T. H. James (*J. Chem. Physics*, 1942, 10, 744—746).— $\text{Ag}_2\text{C}_2\text{O}_4$ ppts. age rapidly, and the ageing is not markedly impeded by adsorption of wool-violet or thiocarbocyanine dyes. Reduction with NH_4OH is retarded by adsorption of gelatin up to formation of a complete adsorption layer, and also by ageing. N_2O formation in the reaction is not reduced by addition of Br^- . L. J. J.

Hexahalogenoaurates. III. Double hexabromoaurates. A. Ferrari and R. Cecconi (*Gazzetta*, 1942, 72, 170—174).—The mixed salts to which Bayer (A., 1920, ii, 688) and Suschnig (A., 1921, ii, 514) attributed the formulæ $\text{Cs}_2\text{Ag}_2\text{Au}_{2-y}\text{X}_y$ ($\text{X} = \text{Cl}$ or Br) can be

formulated $\text{Cs}_2\text{Ag}_y\text{Au}_{(2-y)}\text{X}_2$ (I). For $y = 1$, this gives $\text{Cs}_2\text{AgAuX}_2$ (cf. Wells, A., 1922, ii, 449); for $y = 0$, $\text{Cs}_2\text{Au}_2\text{X}_2$ (cf. Ferrari and Coghi, *Gazzetta*, 1941, 71, 440). From H_4AuBr_4 , AgBr , CsBr , and HBr , a series of products of general formula (I) is obtained. X-Ray study of these shows that they have a monometric lattice of which the consts. are practically uninfluenced by the substitution of Au for Ag; the structure is of the type of $\text{Co}_2\text{Ag}[\text{AuCl}_4]$ and $\text{Cs}_2\text{Au}[\text{AuCl}_4]$ (cf. Ferrari, A., 1937, I, 350). The unit cell contains 4 $[\text{AuBr}_4]^{2-}$ and 8 Cs^+ ; its dimensions are determined by these ions, and thus uninfluenced by the replacement of Ag by Au. Whilst excess of Ag gives $\text{CsAg}[\text{AuBr}_4]$, excess of Au gives CsAuBr_4 . E. W. W.

Preparation and properties of beryllium. R. Rohmer (*Compt. rend.*, 1942, 214, 744—746).—Be-Al alloys have been prepared by heating $\text{BeF}_2 \cdot \text{NaF}$ with Al and BaO_2 or by heating mixtures of BeO (or $\text{BeF}_2 \cdot \text{NaF}$) and Fe_2O_3 with Al, Al + BaO_2 , Si + Ca, or Ca + CaCl_2 ; the impure metal has been separated by heating $\text{BeF}_2 \cdot \text{NaF}$ with Mg or Ca in vac. at 600—700°, melting the mix at 1350°, and separating the resulting layers. J. L. E.

Boric acid and its alkali salts. X. Kernite (rasorite). $\text{Na}_2\text{B}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$. H. Menzel and H. Schulz (*Z. anorg. Chem.*, 1940, 245, 157—220).—Present knowledge of kernite (I) is reviewed. (I) is slowly hydrated in air at room temp. With increasing humidity 10-hydrate is formed which subsequently splits into 5- and amorphous 2-hydrate. In vac. over P_2O_5 or by heating at 100—120° cryst. 2-hydrate is formed. The latter change is reversible and the cryst. product, which has a different X-ray pattern from the product formed from the 10-hydrate, is called metakernite (II). (II) is irreversibly dehydrated at 160—180° to amorphous 1-hydrate. Polytherms of the system $\text{Na}_2\text{B}_4\text{O}_7 \cdot \text{H}_2\text{O}$ between 0° and 100° have been obtained. The stable transition point 10-hydrate \rightleftharpoons (I) is at 58.2° with 14.55% of $\text{Na}_2\text{B}_4\text{O}_7$ in solution, the metastable transition point 10 \rightleftharpoons 5-hydrate is at 60.6° with 16.55% of $\text{Na}_2\text{B}_4\text{O}_7$ in solution, and the metastable transition point 5 \rightleftharpoons 4-hydrate is at 39.5° with $\sim 12\%$ of $\text{Na}_2\text{B}_4\text{O}_7$ in solution. The v.p. equilibrium 10 \rightleftharpoons 5 \rightleftharpoons 4-hydrate has been investigated. The prep. of artificial (I) is described and its crystallography has been examined. The crystallography of natural and synthetic probertite, ulexite, colemanite, and pandermite is discussed. C. R. H.

Action of aluminium halides on aliphatic ethers. I. Aluminium oxyhalides. W. Menzel [with M. Froehlich] (*Ber.*, 1942, 75, [B], 1055—1061).—Freshly sublimed AlCl_3 and Et_2O give the cryst. additive compound $\text{AlCl}_3 \cdot \text{Et}_2\text{O}$, m.p. 35°, which decomposes at 160—170° into EtCl and $\text{Al}(\text{OEt})\text{Cl}_2$ and thence into EtCl and *Al oxychloride* (I), which when thus prepared contains 5—9% of condensation products which cannot be removed by distillation or washing with hydrocarbons since AlOCl is strongly absorptive. With excess of Me_2O the compounds $\text{AlCl}_3 \cdot 2\text{Me}_2\text{O}$, m.p. 57° (decomp.) is formed which at 190—200° affords (I) containing only 1—2% of condensation products. Similarly AlBr_3 and Et_2O give an adduct, m.p. 47°, which passes at 190—195° into EtBr and *Al oxybromide*. The Al oxyhalides are very hygroscopic and cannot be sublimed or distilled. They are insol. in C_6H_6 and hydrocarbons, and sol. in PhNO_2 or COMe_2 to brown or red solutions respectively. AlOCl reacts vigorously with EtOH giving *Al dythoxychloride* which can be isolated by pptn. with Et_2O ; it is also obtained from Al and EtOH-HCl . Attempts to obtain $\text{Al}(\text{OEt})\text{Cl}_2$ by the last method were unsuccessful. With liquid NH_3 , AlOCl gives the compound $\text{AlONH}_2 \cdot \text{NH}_4\text{Cl}$ which continuously evolves NH_3 when exposed to air. It is hydrolysed by H_2O to $\text{Al}(\text{OH})_3$ and NH_4Cl . H. W.

Gallium. VI. Separation of gallium and germanium from alkaline extracts of germanite by electrolysis. VII. Gallium perchlorate hydrates and a gallium perchlorate-urea complex. D. J. Lloyd and W. Pugh (*J.C.S.*, 1943, 74—76, 76—77).—VI. An alkaline extract of germanite was electrolysed with Cu or Ni cathodes and Pt anode at 25—35° and c.d. 0.016—0.025 amp. per sq. cm. Alkali concn. had little effect on efficiency. Best results were obtained with Ga and Ge concns. 0.5 and 3 g. per l. respectively. The deposit, which represented $>80\%$ recovery of Ga and Ge, was chlorinated and the mixed tetrachlorides separated by distilling GeCl_4 and recovering the Ga from the residual solution by electrolysis after making alkaline.

VII. $\text{Ga}(\text{ClO}_4)_3 \cdot 6\text{H}_2\text{O}$ (I) and $\text{Ga}(\text{ClO}_4)_3 \cdot 9\text{H}_2\text{O}$ (II) were prepared. (I) is stable but (II) loses $3\text{H}_2\text{O}$ at 100°. At higher temp. $3\text{Ga}_2\text{O}_3 \cdot \text{Ga}(\text{ClO}_4)_3$ appears to be formed. $[\text{Ga}(\text{CON}_2\text{H}_4)_6](\text{ClO}_4)_3$, m.p. 179°, is formed by interaction of 1 mol. of (II) with 6 mols. of $\text{CO}(\text{NH}_2)_2$ in EtOH solution. Its aq. solution is unstable, $\text{Ga}(\text{OH})_3$ being pptd. on warming. A compound with 6 mols. of $\text{CS}(\text{NH}_2)_2$ is formed in solution but it could not be isolated. C. R. H.

Formation of elementary carbon from sugar charcoal. U. Hofmann and F. Sinkel (*Z. anorg. Chem.*, 1940, 245, 85—102).—Charcoal, prepared by heating sucrose at 280—300° for 18 hr., was further heated at 450—1000° in H_2 for 10—45 hr. X-Ray analysis showed that samples prepared at the highest temp. consisted of graphite-like crystals of dimensions $\sim 10 \times 30 \times 30$ Å. Samples prepared at lower temp. showed similar structure with the particle size some-

what smaller. With increasing temp. of prep. the electrical resistance decreased from $\sim 10^7$ to 0.4 ohm per cm. The low-temp. products neutralised NaOH and liberated AcOH from $\text{Ca}(\text{OAc})_2$. This is probably due to the presence of substances resembling humic acids since they were sol. in the same solvents as humic acids.

C. R. H.

New halides of silicon. V. Silicon iodides. R. Schwarz and A. Pflugmacher (*Ber.*, 1942, 75, [B], 1062—1071).—Passage of I vapour in dry N_2 over Si (best obtained by heating pure SiO_2 with Mg and MgO at $\sim 800^\circ$) heated at 650° gives SiI_4 , m.p. 120.5° , b.p. 287.5° . This is immediately decomposed by air and transformed by dry, finely divided Ag at 250° into Si_2I_6 , best purified from unchanged SiI_4 by fractional sublimation in a high vac. Evidence against the existence of iodides more complex than Si_2I_6 is adduced. Si_2I_6 and KOH react thus: $\text{Si}_2\text{I}_6 + 10\text{KOH} = 2\text{K}_2\text{SiO}_3 + 6\text{KI} + \text{H}_2\text{O} + \text{H}_2$. Thermal decomp. of Si_2I_6 at $350\text{--}400^\circ$ gives *Si monoiodide*, $(\text{SiI})_n$, an amorphous orange-red powder which becomes (reversibly) dark rust-red when heated. It is insol. in all org. media and has no m.p. or b.p. No evidence of the existence of Friedel and Ladenburg's SiI_2 was obtained. $(\text{SiI})_n$ is transformed by N-HCl at 0° without evolution of H_2 into *hyposilicic acid* (I), $\cdot(\text{OH})_2\text{Si}\cdot\text{SiH}(\text{OH})\cdot\text{SiH}(\text{OH})\cdot\text{Si}(\text{OH})_2\cdot$, a homogeneous, amorphous, ivory-coloured compound, very sensitive to oxidising acids and alkalis but remarkably stable to dry O_2 . At 460° (I) evolves H_2 leaving the copper-coloured substances, $\cdot(\text{OH})_2\text{Si}\cdot\text{SiO}\cdot\text{SiO}\cdot\text{Si}(\text{OH})_2\cdot$ which does not react vigorously with alkali. At 580° there is again evolution of H_2 with production of a tobacco-brown material of doubtful homogeneity. Above 600° the remaining H is evolved, leaving a mixture of Si and SiO_2 .

H. W.

Preparation of germanium tetrachloride, GeCl_4 . L. S. Foster, J. W. Drenan, and A. F. Williston (*J. Amer. Chem. Soc.*, 1942, 64, 3042).—When GeO_2 , suspended in 6N-HCl, is refluxed with HCl being passed in some GeCl_4 escapes through the condenser and can be frozen out by a CO_2 - Pr^t OH mixture.

W. R. A.

Zirconium vanadates. I. Existence of the vanadate, $3\text{ZrO}_2\cdot 2\text{V}_2\text{O}_5\cdot 9\text{H}_2\text{O}$. II. Existence and structure of the pyrovanadate, ZrV_2O_7 . G. Peyronel (*Gazzetta*, 1942, 72, 77—83, 83—89).—I. Aq. NH_4VO_3 (I) and $\text{ZrO}(\text{NO}_3)_2$ (II) [Zr/V (mols.) = 4 to 1.33; pH (quinhydrone) 1.25—1.51] at 70° give a product which is apparently a complex polymeride since its conc. aq. solutions are viscous or gels. When Zr/V (mols.) is < 1.33 (pH 2.1—6.9), *zirconyl tetravanadate*, $(\text{ZrO})_3\text{V}_4\text{O}_{13}\cdot 9\text{H}_2\text{O}$ (III), is pptd., which does not react with excess of (I).

II. Suitable proportions of (I) and (II) in presence of H_2O_2 give ppts. in which Zr/V (mols.) = 3/2, 1/1, and 1/2, and in which $\text{V}_2\text{O}_5\cdot x\text{H}_2\text{O}$ is considered to be adsorbed on (III), since when the products have been heated at $250\text{--}670^\circ$ they give identical X-ray photograms, corresponding with *zirconium pyrovanadate*, ZrV_2O_7 (IV) (monometric, face-centred, a_0 8.74 Å.; space-group $T_h^6\text{--}Pa3$) (structure discussed), also obtained by heating (III). (IV) so prepared contains ZrO_2 . At $670\text{--}760^\circ$, (IV) decomposes into ZrO_2 and a product richer in V. Vanadates of Ti and Sn also give adsorption products under similar conditions.

E. W. W.

Zirconium arsenates. I. Existence of the arsenates $\text{ZrO}_2\cdot \text{As}_2\text{O}_5\cdot \text{H}_2\text{O}$ and $\text{ZrO}(\text{AsO}_3)_2$. II. Thermal decomposition of $\text{ZrO}(\text{AsO}_3)_2$; existence of $(\text{ZrO})_2\text{As}_2\text{O}_7$ and $(\text{ZrO})_3(\text{AsO}_4)_2$. G. Peyronel (*Gazzetta*, 1942, 72, 89—93, 93—97).—I. $\text{ZrO}(\text{NO}_3)_2$ with excess of 30—40% aq. H_3AsO_4 at $180\text{--}190^\circ$ (10 atm.; 8—10 hr.) gives the *arsenate*, $\text{ZrO}_2\cdot \text{As}_2\text{O}_5\cdot \text{H}_2\text{O}$, which is regarded as $\text{ZrO}(\text{H}_2\text{AsO}_4)_2$. At $280\text{--}300^\circ$ this loses H_2O , and the product $\text{ZrO}_2\cdot \text{As}_2\text{O}_5$ (I), shown by X-ray study to be of different structure from ZrP_2O_7 , is regarded as $\text{ZrO}(\text{AsO}_3)_2$.

II. At 900° , (I) gives the *pyroarsenate*, $(\text{ZrO})_2\text{As}_2\text{O}_7$, which at 950° gives the *orthoarsenate*, $(\text{ZrO})_3(\text{AsO}_4)_2$, and at 1000° , ZrO_2 , As_2O_3 , and O_2 . X-Ray study shows that all these arsenates are cryst.

E. W. W.

Disperity measurements on a highly polymerised metaphosphate prepared according to Tammann. O. Lamm and H. Malmgren (*Z. anorg. Chem.*, 1940, 245, 103—120).— KH_2PO_4 was heated to redness for 20 min. and powdered. When treated with conc. aq. NaCl the powder swelled to a viscous mass. The η of a 1% aq. solution of the powder is 5 times η of H_3O . Dil. HCl, NaOH, and NaCNS reduce η to its normal val. whilst more conc. solutions cause pptn. Data for sedimentation const., diffusion coeff., and partial sp. vol. have been obtained. The mol. wt. of freshly prepared polymeride is $\sim 20,000$, but after treatment with NaCNS or NaOH it increases to $\sim 100,000$. Sedimentation const. data for technical hexametaphosphate suggest the presence of polymeride.

C. R. H.

Formation of insoluble sulphur in the presence of gases other than sulphur dioxide. E. A. Fehnel (*J. Amer. Chem. Soc.*, 1942, 64, 3041—3042).—Insol. plastic S has been prepared in a closed system in presence of various gases. Clear, amber, plastic masses, formed in contact with air, SO_2 , and HCl, contained 36% of insol. S after 6 days; with H_2S the clear amber mass gave 8%, whilst with N_2 and NH_3 an opaque, yellow, brittle mass was formed containing

$< 4\%$ of insol. S. The plasticity of the insol. S formed in presence of HCl or H_2S is short-lived. The data disprove the theory that plasticity results from the presence of SO_2 .

W. R. A.

Polythionic acids and their formation. VI. New preparations for potassium tri- and tetra-thionate. H. Stamm and M. Goehring [with U. Feldmann] (*Z. anorg. Chem.*, 1942, 250, 226—228).— $\text{K}_2\text{S}_3\text{O}_8$ is prepared by mixing 800 c.c. of 5M- KHSO_3 (pH ~ 7) cooled to -5° with a solution of SCl_2 in light petroleum (I) (100 g. in 1.5 l.) cooled to -20° . The temp. must not rise above 10° . $\text{K}_2\text{S}_3\text{O}_8$ ($\sim 86\%$ purity) is pptd. at 0° and can be filtered off and washed with COMe_2 . To prepare $\text{K}_2\text{S}_4\text{O}_8$, a solution of SCl_2 (75 g.) in (I) (500 c.c.) cooled to -15° is mixed with 750 c.c. of saturated aq. SO_2 . (I) is removed and air is passed through the aq. layer to remove SO_2 , after which the solution is cooled to 0° and a cold solution of 150 g. of KOH in 1 l. of EtOH added. $\text{K}_2\text{S}_4\text{O}_8$ containing $\sim 10\%$ of KCl separates. Methods for recrystallising both compounds are given.

C. R. H.

Chromium tetrachloride. H. von Wartenberg (*Z. anorg. Chem.*, 1942, 250, 122—126).—Gaseous CrCl_4 is formed when CrCl_3 and Cl_2 react at $600\text{--}700^\circ$ and can be condensed by rapid cooling with solid CO_2 . The condensate contains CrCl_3 , formed as the result of decomp. of CrCl_4 which commences at $\sim -80^\circ$.

C. R. H.

Anhydrous iron alums. N. Schischkin [with E. A. Bachrak, A. W. Smirnowa, and T. S. Badeewa] (*Z. anorg. Chem.*, 1940, 245, 226—228).—Anhyd. $\text{NaFe}(\text{SO}_4)_2$, $\text{KFe}(\text{SO}_4)_2$, and $\text{NH}_4\text{Fe}(\text{SO}_4)_2$ can be prepared by dissolving suitable amounts of alkali sulphate and FeSO_4 in hot H_2SO_4 ($\sim 16\%$) and oxidising with HNO_3 . After filtering, the solution is conc. and hot H_2SO_4 ($\sim 80\%$) is added. Conc. is continued until crystallisation begins, when the liquid is filtered hot through a porcelain or asbestos filter. The crystals are washed with abs. EtOH and dried in vac. over H_2SO_4 .

C. R. H.

Reactions of cobaltic, cobaltous, and ferrous oxides in liquid ammonia. T. E. Moore and G. W. Watt (*J. Amer. Chem. Soc.*, 1942, 64, 2772—2775).—At room temp. Co_2O_3 , CoO , and FeO do not dissolve in or react with liquid NH_3 . Co_2O_3 does not react with solutions of NH_4Cl or NH_4NO_3 in liquid NH_3 at 100° but, under similar conditions, CoO and FeO are dissolved to some extent. Each reacts slowly with liquid NH_3 solutions of KNH_2 at room temp. to give complex mixtures only part of which is sol. Whereas Co_2O_3 is reduced to CoO and ultimately to Co by liquid NH_3 solutions of K at 0° , FeO is reduced to Fe to only a very limited extent.

W. R. A.

Nitrosyl and hydroxylamine derivatives of $\text{Ni}(\text{CN})_2$. L. Malatesta and R. Pizzotti (*Gazzetta*, 1942, 72, 174—183).—The violet salt (I), new formula $\text{K}_2[\text{Ni}^{\text{III}}(\text{CN})_5\cdot \text{N}(\text{OH})\cdot \text{Ni}^{\text{III}}(\text{CN})_3]$ (cf. Job *et al.*, A., 1923, i, 904; Manchot, A., 1927, 33; Anderson, A., 1937, I, 95), is obtained either from aq. $\text{K}_2[\text{Ni}(\text{CN})_4]$ (II), $\text{NH}_2\text{OH}\cdot \text{HCl}$, and KOH, or from (II), $\text{Ni}(\text{CN})_2$ and KOH with $\text{N}_2\text{H}_4\cdot \text{H}_2\text{O}$, followed by NO. Aq. (I) with dil. AcOH or HgCl_2 gives an unstable compound of varying composition, $\{\text{H}[\text{Ni}(\text{NO})(\text{CN})_2]\}_2\cdot \text{Ni}(\text{CN})_2$ (?), which in boiling H_2O loses $\text{Ni}(\text{CN})_2$, forming a stable blue compound, $\text{H}[\text{Ni}(\text{NO})(\text{CN})_2]$. The presence of the $\cdot \text{N}(\text{OH})\cdot$ bridge in (I) is shown by decomp. by HgO , giving N_2 , N_2O , and NO in the same proportions as from NH_2OH .

E. W. W.

Co-ordination tenacity of unsaturated molecules.—See A., 1943, II, 103.

X.—ANALYSIS.

Quantitative analysis for impurities by intensity estimation of one spectral line.—See B., 1943, I, 173.

Adsorption in chemical analysis. G. N. Copley (*Ind. Chem.*, 1943, 19, 142—148, 169).—A review.

L. S. T.

Adsorption analysis of solutions. A. Tiselius (*Arkiv Kemi, Min., Geol.*, 1941, 14, B, No. 22, 5 pp.).—In the method suggested a boundary between the solution and pure solvent is allowed to rise slowly through a vertical column containing a layer of powdered adsorbent. The boundary remains sharp but it is more or less retarded as compared with the meniscus of the solvent according to the extent to which the solute is adsorbed. A relationship between this retardation vol. and the adsorption isotherm is derived. With a mixture containing several components the boundary is split into an equal no. of separate boundaries which may be observed by Toepler's method. The separation by this method of a solution containing 1% each of NaCl, glucose, and PhOH is illustrated.

J. W. S.

Reproducibility of pH measurements with glass electrode hydrogen ion meters. R. U. Bonnar (*J. Assoc. Off. Agric. Chem.*, 1942, 25, 973—980).—Collaborative results for test solutions are reported and analysed. The measurements converged to 0.01 pH. For temp.-sensitive systems discrepancies > 0.3 pH may be expected. Systems permitting consistent measurements should show mutual agreement within ± 0.05 pH.

A. A. E.

Separation of iodides, bromides, and chlorides. N. E. Freeman (*J. Assoc. Off. Agric. Chem.*, 1942, 25, 833—839).—Ashing methods for the separation of halides from org. matter are unsuitable if I' is

present; Br' and Cl' are readily retained by alkaline fixatives. Except for certain org. compounds the gravimetric open Carius procedure is recommended. The NH_4OH method for recovery of halides from pptd. Ag salts is trustworthy. 5% aq. KI is a satisfactory absorption medium for I if CO_2 is used for aëration. $\text{Ce}(\text{SO}_4)_2$ is preferred for conversion of Br' into Br. A. A. E.

Purification and analytical determination of gaseous fluorine. H. Schmitz and H. J. Schumacher (*Z. anorg. Chem.*, 1940, 245, 221—225).— F_2 , prepared by electrolysis fused KHF_2 , is cooled in liquid O_2 to remove impurities and condensed in liquid N_2 . Evaporation gives 97.5% pure F_2 . Gaseous F_2 can be analysed by measuring the reduction in vol. when shaken with Hg. C. R. H.

Amperometric determination of sulphates. W. C. Davies and C. Key (*Ind. Chem.*, 1943, 19, 167—169).—Apparatus and method for determining residual SO_4^{2-} in $\text{Al}_2\text{O}_3 \cdot n\text{H}_2\text{O}$ by titration with 0.05M- $\text{Pb}(\text{NO}_3)_2$ at a controlled pH in an atm. of H_2 are described. The method has been successively applied also to the determination of SO_4^{2-} in boiler H_2O and in wash waters. L. S. T.

Micro-determination of sulphates in sea-water. D. A. Webb (*J. Exp. Biol.*, 1939, 16, 438—445).—AcOH and solid $\text{Ba}(\text{IO}_3)_2$ are added and after 4 hr. excess of acidified KI liberates free I in amount \propto the original $[\text{SO}_4^{2-}]$. The incompleteness of the reactions necessitates the use of a comparable standardised control solution. D. M. SA.

[Volumetric] determination of selenious acid and selenites. D. F. Adams and L. I. Gilbertson (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 926—927).— SeO_2 is oxidised to SeO_4^{2-} in aq. HNO_3 by excess of aq. KBrO_3 , which is back-titrated with Na_2AsO_2 (Fast Red B) in presence of HCl. Details of procedure and test data are given. Colourless cations that form sol. selenates, and excess of NO_3^- , do not interfere. Halides must be absent. The method is suitable for determining SeO_2 and H_2SeO_3 in presence of SeO_4^{2-} . L. S. T.

Rapid determination of phosphate content of boiler water.—See B., 1943, I, 133.

Accurate determination of calcium, without reprecipitation, in presence of aluminium, iron, magnesium, manganese, phosphorus, sodium, and titanium. W. H. McComas, jun., and W. Rieman, 3rd. (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 929—931).— $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ is pptd. slowly in hot solution containing HCO_2H , digested for 5 min., cooled rapidly to room temp., and digested at 25° after adjustment of pH to 3.70 by means of HCO_2NH_4 . The washed ppt. is dissolved in dil. H_2SO_4 and titrated with aq. KMnO_4 according to the Fowler-Bright procedure. Test data for pure solutions and for limestones, and data showing the effect of changes in various conditions, are recorded. L. S. T.

Alkalimetric method of determination of cadmium and zinc. M. M. Tillu and M. S. Telang (*J. Univ. Bombay*, 1942, 11, A, Part 3, 85—86).—In a mixture of Cd and Zn the Cd is pptd. by NaOH as $\text{Cd}(\text{OH})_2$, which is determined by the author's method (A., 1943, I, 24); the Zn is pptd. with NaHCO_3 as ZnCO_3 , which with KI yields K_2CO_3 , titrated against HCl using Me-orange. F. R. G.

Systematic identification of the common metallic coatings.—See B., 1943, I, 172.

Polarographic determination of lead in lead-bearing steels.—See B., 1943, I, 163.

Determinations [of metals] with Chinosol. H. T. Liem (*Pharm. Tijds. Nederl. Indië*, 1942, 19, 13—16).—Chinosol ($\text{C}_7\text{H}_5\text{ON} \cdot \text{KHSO}_4$) or Superol can replace 8-hydroxyquinoline with advantage for the determination of Cu, Al, and Zn. S. C.

Colour reactions of o-phenanthroline derivatives. M. L. Moss [with M. G. Mellon, and G. F. Smith] (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 931—933).—The reactions of 5-chloro-, 5-bromo-, 5-methyl- (I), nitro-, and 5-nitro-6-methyl-o-phenanthroline with Fe, Cu, and Mo have been investigated. A spectrophotometric investigation indicates that the compounds with Fe²⁺ can be used for colorimetric determinations. With the exception of the (I) derivative, the complexes formed are not exceptionally stable, and are not preferred to o-phenanthroline (II)-Fe²⁺ complex. Ammoniacal Cu^{2+} solutions containing (II) or the above derivatives form insol., brown complexes with Cu^{2+} when treated with NH_4OH . Solutions of these complexes in org. solvents are suitable for colorimetry. The (II) reagents are not satisfactory precipitants for Cu. MoO_4^{2-} with (II) or its derivatives gives a reddish colour on reduction with H_2SnCl_4 . The reaction will detect 0.5 p.p.m. of Mo, but is unsuitable for quant. purposes. L. S. T.

[Determination of nickel in used plating baths].—See B., 1943, I, 171.

Qualitative semimicro-analysis with reference to Noyes and Bray's system. Aluminium group. (Miss) C. C. Miller (*J.C.S.*, 1943, 72—74).—An analytical scheme for the detection and approx. determination of 0.25—50 mg. of Al, Cr, or Zn and 0.25—10 mg. of Be, W, U, or V in mixtures containing PO_4^{3-} is presented. The solution of mixed chlorides is treated with Na_2O_2 and then boiled to decompose excess of Na_2O_2 . Separate portions of the solution are tested for Be (fluorescence with morin), W [$1:3:4\text{-C}_6\text{H}_5\text{Me}(\text{SH})_2$], V

(tannin), Zn (pptn. of Zn Hg thiocyanate), and Cr [$\text{CO}(\text{NH}_4\text{NHPH})$], after conversion into Cr^{VI} . Al and U are separated by passing CO_2 and filtering, the ppt. containing Al and the filtrate U. Al is detected by Cs alum pptn. and U by pptn. with $\text{K}_4\text{Fe}(\text{CN})_6$ after removal of V by cupferron and elimination of W. C. R. H.

Direct determination of aluminium in alloys.—See B., 1943, I, 170.

Dichromate-ferrous sulphate method for [determining] antimony. R. B. Neill (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 955).—Standard $\text{K}_2\text{Cr}_2\text{O}_7$ is added to the aq. solution containing Sb^{III} , H_2SO_4 , and HCl until the orange colour of an excess can be detected. H_3PO_4 and $\text{NHPH} \cdot \text{C}_6\text{H}_5 \cdot \text{SO}_3\text{H}$ are added, and the solution is titrated with Fe^{II} solution. The $\text{K}_2\text{Cr}_2\text{O}_7$ equiv. of the Fe^{II} solution is determined by adding to the titrated solution a vol. equal to that used previously and titrating with $\text{K}_2\text{Cr}_2\text{O}_7$. Methods for dissolving Sn-Pb alloys containing Sb are described, and test data given. L. S. T.

XI.—APPARATUS ETC.

Apparatus for the measurement of thermal expansion at temperatures up to 100°. H. H. Macey (*J. Sci. Instr.*, 1943, 20, 48—49).—By means of an optical system the length of a rod is compared with that of a rod of SiO_2 of known expansion. A. A. E.

Temperature determinations in theory and practice. N. R. Tawde and H. A. Unvala (*J. Univ. Bombay*, 1942, 11, A, Part 3, 166—171).—A survey. F. R. G.

Photo-electric tricolorimeter. G. F. G. Knipe and J. B. Reid (*Proc. Physical Soc.*, 1943, 55, 81—91).—The colorimeter described is designed to measure the colour of nearly white papers and to specify differences which are visible but indeterminable by visual colorimeters. It makes use of a double monochromator system and three diaphragms which select the correct proportion of light of each λ , enabling the result to be given in C.I.E. units directly. Calibration and performance are reported. N. M. B.

Ultrasonic fluorometer. G. Goudet (*Compt. rend.*, 1942, 214, 742—744).—A new fluorometer is described and the mathematical principle on which it depends is presented. J. L. E.

Cold-cathode X-ray diffraction tube. F. G. Chesley (*Rev. Sci. Instr.*, 1943, 14, 3—5).—Metal bellows permit adjustment of the cathode-target distance, and a simple target sealing assembly is employed. A. A. E.

Variable ratio-arm conductivity bridge. W. F. Luder (*Rev. Sci. Instr.*, 1943, 14, 1—3).—The bridge has a range of precision measurement of $>10^6 \Omega$. A. A. E.

Preparation and testing of satisfactory standard electrodes for spectrographic analysis of light metals.—See B., 1943, I, 172.

Circuits employing thyatrons and ignitrons. A. J. Maddock (*J. Sci. Instr.*, 1943, 20, 37—45).—Typical examples of circuits and applications indicating different methods of using thermionic gas-filled triodes and Hg pool diodes with igniter electrode are described and diagrams given. A. A. E.

Geiger counting methods. W. Bothe (*Naturwiss.*, 1942, 30, 593—599).—A review describing the construction and uses of various types of counter. A. J. M.

Localisation of the discharge in Geiger-Müller counters. M. H. Wilkening and W. R. Kanne (*Physical Rev.*, 1942, [ii], 62, 534—537).—The efficiency of various localising devices is investigated as a function of EtOH concn. in an A-EtOH filling. Localisation is more complete at low vals. of overvoltage. The effectiveness is given of various gas fillings, including inorg. gases which show both localisation and fast counter action. N. M. B.

Limits of resolution of the emission electron microscope. E. Brüche (*Kolloid-Z.*, 1942, 100, 192—206).—Applications of the emission electron microscope are described and the limits of resolution discussed. F. L. U.

[Optical] definition of objects lying near the limits of resolution of the microscope and of the electron microscope. M. von Ardenne (*Kolloid-Z.*, 1942, 100, 206—211).—The effects of slight alteration in adjustment on the definition of structures the dimensions of which lie near the limit of resolution are discussed and illustrated. In the electron microscope errors of adjustment lead to diminution of contrast but not to a false image, whereas with an ordinary microscope the lines and spaces of a grid having a const. equal to or twice as great as the resolution of the instrument may appear interchanged. In practice it is better to work with too large than with too small an effective aperture in the electron microscope. F. L. U.

Electron microscope images at higher pressures. E. Ruska (*Kolloid-Z.*, 1942, 100, 212—219).—Arrangements for the electron-microscopical examination of objects maintained under gas pressures up to 200 torr. are described. The images obtained show considerably reduced definition and contrast; the deterioration increases with the pressure, with the d of the gas, and with the thickness of the atm., and the object also may sustain damage from secondary

radiation. The conversion of colloidal Ag in an atm. of Cl_2 into AgCl has been studied. F. L. U.

Thermally prepared aluminium oxide films. H. Mahl (*Kolloid-Z.*, 1942, 100, 219—228).— Al_2O_3 films made by heating very pure Al at 500° , examined by the electron microscope, are seen to consist of scaly crystallites of the γ -oxide lying parallel to the metal surface. Films formed by passing a Bunsen flame over Al foil are very fine-grained and show no marked fibrous structure. The crystal scales produced by continued heating of the metal are generally formed by the collective crystallisation of very fine primary oxide grains, which are themselves formed anew as soon as the initial oxide layer becomes pervious to O_2 through crystallisation. F. L. U.

Preparation of thermally stable carrier-films for determining lattice constants of alloys by electron diffraction. A. Boettcher (*Kolloid-Z.*, 1942, 100, 228—230; cf. Hass and Kehler, A., 1942, I, 250).—Films of Al_2O_3 formed by condensing Al vapour on a surface of rock salt were examined by electron diffraction. Films annealed at 600 — 900° consist of γ - Al_2O_3 with a 7.89 ± 0.01 Å. The use of such films as supports is illustrated by a study of the Ag-Al system, for which vapours of both metals were condensed on the same carrier-film. The diffraction patterns of the various phases, superposed on that of the γ - Al_2O_3 , allow the lattice consts. to be determined with an accuracy of 0.15%. F. L. U.

Damping device for high-capacity balances. H. L. Andrews, F. W. Oberst, and E. G. Williams (*Rev. Sci. Instr.*, 1943, 14, 22—23).—An electromagnetic circuit for a 100-kg. balance requires only ~ 0.5 amp. at 12 v. and does not affect sensitivity. Loss in wt., e.g., of a man at rest, can be recorded graphically. A. A. E.

A centrifugal micro-filter. F. Boerner (*Amer. J. clin. Path. Tech. Sect.*, 1942, 6, 68). C. J. C. B.

Simple automatic distilling unit. B. N. Craver and H. L. Williamson (*J. Lab. clin. Med.*, 1943, 28, 199—200).—The siphon principle is used. C. J. C. B.

Accurate cheap constant-temperature water-bath. B. C. Riggs (*J. Lab. clin. Med.*, 1943, 28, 210—213). C. J. C. B.

Adsorption analysis: experimental arrangement and some results with mixtures of glucose and lactose. A. Tiselius (*Arkiv Kemi, Min., Geol.*, 1941, 14, B, No. 32, 8 pp.; cf. A., 1943, I, 136).—The apparatus used in the author's method is described. The relationship between the retardation vol. and the adsorption isotherm derived previously holds satisfactorily for aq. solutions of glucose and lactose, alone or together. J. W. S.

Accurate high-sensitivity Apiezon oil McLeod gauge. J. Bannon (*Rev. Sci. Instr.*, 1943, 14, 6—10).—Since the oil absorbs gas it is subjected continuously to very low pressure, the reservoir being in gas communication with the bulb, and the oil displaced by an externally controlled plunger. For single measurements, accuracy is $\sim 1, 2, 8$, and 25% for $10^{-3}, 10^{-4}, 10^{-5}$, and 10^{-6} mm. Hg respectively. A. A. E.

Sensitive relay operated by fluid flow. J. H. J. Poole and J. C. Gilmour (*J. Sci. Instr.*, 1943, 20, 49—50).—A piston provided with an axial hole moves freely in a vertical glass tube and completes an electrical circuit which is broken when the flow of H_2O falls below a certain adjustable val. A. A. E.

Rapid determination of very small gas flows. Soap-bubble method. L. Silverman and R. M. Thomson (*Ind. Eng. Chem. [Anal.]*, 1942, 14, 928).—Details of procedure, and performance of the method, which involves the formation and measurement of soap bubbles at a capillary tip, are given. The method is suitable for the calibration of needle valves, capillary flowmeters, and other indicating devices. L. S. T.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

George Macintosh (1739—1807) and Charles Macintosh (1766—1842). N. L. Clow and A. Clow (*Chem. and Ind.*, 1943, 104—106).

XIII.—GEOCHEMISTRY.

Chemical evolution of the ocean. E. J. Conway (*Proc. Roy. Irish Acad.*, 1943, 48, B, 161—212).—General principles applicable to the development of the theory of oceanic evolution are outlined. This evolution is treated mainly on the basis of a constancy of oceanic vol. with the addition of HCl either from the original atm. or from volcanoes. Removal of K⁺ from the ocean by living organisms, with subsequent conversion into glauconite and fall of [K⁺], has played a major part in the chemical evolution of the ocean. The oceanic composition of the early Ordovician period, in or near to which the vertebrata first appeared, is compared with that of mammalian blood-plasma. The discrepancy between vals. for the age of the ocean as computed from the data of chemical denudation and from radioactive change is discussed. L. S. T.

Differential density of ground water as a factor in circulation, oxidation, and ore deposition. J. S. Brown (*Econ. Geol.*, 1942, 37, 310—317).—Evidence that differences in ρ of natural ground waters are sufficient to explain their migrations to important depths below the H_2O table in certain cases, producing chemical changes in wall rock, is presented. L. S. T.

Some peculiarities of the winter hydrochemical regime of the Volga River in 1939 and 1940, and their causes. S. P. Shdanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 84—88).—In 1939 there was greatly increased fish mortality in the Volga, which has been traced to O_2 deficiency in the H_2O . This deficiency was caused by the oxidation of effluents from paper mills by the O_2 dissolved in the H_2O . A. J. M.

Chlorophæite-bearing basalts from the Cuddupah traps (Precambrian). M. R. S. Rao (*Current Sci.*, 1942, 11, 396).—Chlorophæite (with $n >$ that of Canada balsam) occurs as amoeboid patches in the top basaltic flows of the Cuddupah system (S. India), where it has developed at the expense of primary minerals. A. Li.

Rôle of the logarithmically normal law of frequency distribution in petrology and geochemistry. N. K. Razumovski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 48—49).—The frequency distribution of the content of elements in rocks obeys a logarithmic law. Averages obtained by the arithmetic mean method should be revised. A. J. M.

Admixture of barium and calcium in celestite. L. M. Miropolski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 64—65).—The % of BaO and CaO in a no. of samples of celestite (I) has been determined. The presence of Ba and Ca is determined by the medium in which the crystallisation of (I) occurred, and it can be interpreted by using the principle of polar directed isovalent isomorphism, or that of compensatory isomorphism. A. J. M.

Metaloparite, a new mineral from the Lovozero Tundras. V. I. Gerasimovski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 61—63).—The mineral, which was discovered in the Lovozero alkaline massif (Kola peninsula), is a secondary mineral, closely resembling loparite. The physical and optical properties of the mineral are recorded, and an analysis is given. A. J. M.

Augite from Cape Tourmente [Quebec]. H. M. Putman (*Natural. Canad.*, 1942, 69, 261—263).—A chemical analysis is given. ρ is 3.48, $a:b:c = 1.902:1:0.584$, β $105^\circ 50'$. L. S. T.

Metachromatism of minerals. A. S. Uklonski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 209—212).—A list of colour changes produced in minerals by illumination with a Hg-vapour lamp is given. L. J. J.

Heteromorph of venanzite. A. Holmes (*Geol. Mag.*, 1942, 79, 225—232).—Chemical analyses of venanzite, mafurite-venanzite, and related rocks are recorded and discussed. L. S. T.

Mineralisation of the Ajo Copper District, Arizona. J. Gilluly (*Econ. Geol.*, 1942, 37, 247—309).—The New Cornelia ore body at Ajo is a "porphyry copper" deposit consisting of chalcopyrite, with subordinate bornite, disseminated in quartz monzonite porphyry, and is the end product of a series of alterations of the porphyry through magmatic processes. Chemical analyses of the monzonite are recorded. L. S. T.

Physiographic setting of the nitrate deposits of Tarapacá, Chile; its bearing on the problem of origin and concentration. J. L. Rich (*Econ. Geol.*, 1942, 37, 188—214).—Analysis of various theories of origin points to a derivation by weathering and concn. from the predominating lavas and tuffs of the bed rock. This agrees with features of the topographic setting revealed by aerial photographs. L. S. T.

Middle Jurassic rocks of Yorkshire. Petrological and palaeogeographical study. F. Smithson (*Quart. J. Geol. Soc.*, 1942, 98, 27—59).—20 mineral species are described and illustrated, and the % composition of the heavy minerals is discussed. L. S. T.

Great Nordenskiöld [metallic] iron boulder from Ovifak [Greenland]: microstructure and mode of formation. H. Löfquist and C. Benedicks (*Kungl. Svenska Vet. Akad. Handl.*, 1941, 19, 1—96).—The authors' previously published work (A., 1942, I, 346) is described in greater detail. The disintegration of samples of the boulder Fe stored indoors is due to formation of cracks in $\text{Fe}(\text{OH})_3$ -rich areas on drying, followed by enlargement of these by rusting. M. H. M. A.

Rôle and significance of epeirogenetic movements in the formation of deposits of iron and manganese ores and bauxites. B. P. Krotov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 54—56).—The effect of epeirogenesis on the formation of ore deposits is due to the fact that it brings about the physico-geographical conditions for the formation of such deposits. Epeirogenetic movements also affect the composition of the deposits. A. J. M.

Source beds of manganese ore in the Appalachian Valley. G. W. Stose (*Econ. Geol.*, 1942, 37, 163—172).—The Mn oxide occurs in clays residual from impure limestone associated with glauconitic quartzite. Origin is discussed. L. S. T.

A., I.—General, Physical, and Inorganic Chemistry

JUNE, 1943.

I.—SUB-ATOMICS.

Open-arc method of exciting the Balmer series. A. S. Ganesan (*Current Sci.*, 1943, 12, 18—19).—When a steady stream of H₂, coal gas, or steam is passed into a Cu arc the Balmer series is excited and the OH bands ${}^2\Sigma \rightleftharpoons {}^2\Pi$ at 3064 and 2811 Å. appear. These features are not exhibited with Zn, Al, Fe, or C arcs and tentative explanations are advanced. W. R. A.

Identification of lines in the solar corona. D. N. Kundu (*Indian J. Physics*, 1942, 16, 317—328).—The probable positions of $3p\ {}^2P_{1/2} \rightarrow 2p\ {}^2P_{1/2}$ and $3p\ {}^2P_{3/2} \rightarrow 2p\ {}^2P_{3/2}$ lines of elements adjoining Fe, derived on the basis of Saha's threefold nuclear fission theory, are calc. The former group cannot be traced beyond Ni, nor the latter beyond Cu, because the $\lambda\lambda$ are <3000 Å. The coronal line 4359 Å. is tentatively ascribed to Co. L. J. J.

Photo-electric efficiencies of some metals in the soft X-ray region. S. R. Rao and K. K. Ramamurti (*Current Sci.*, 1942, 11, 460—461).—The similarity of photo-electric properties due to soft X-rays and ultra-violet light is extended by measurements which show the decreasing order of photo-electric sensitivity: Zn, Cd, Sn, Pb, Al, Mg, Ag, Ni, Co, Fe, in agreement with available data. Zn, Pb, Al, and Mg form a group with large sensitivity and small work function, and Ag, Ni, and Fe form a group with large work function and small sensitivity. N. M. B.

Magnetic moments and the vibratory electron. I. A. Robertson (*Phil. Mag.*, 1943, [vii], 34, 182—196).—A discrepancy between Ampère's theorem and the magnetic moments of revolving electron systems calc. by the vibratory electron method is considered mathematically. A magnetic moment is not an intrinsic property of a revolving electron, since the moment depends on the orientation of neighbouring electron systems. A. J. E. W.

Supposed β -radiation of radium-A; existence in nature of element 85. B. Karlik and T. Bernert (*Naturwiss.*, 1942, 30, 685—686).—Repetition of the work of Minder (cf. A., 1941, I, 141) affords no evidence for a β -radiation from Ra-A of the recorded intensity. The occurrence of element 85 in a natural disintegration series is therefore questioned. Minder's positive effect is attributed to the presence of traces of Ra-A in Rn in the ionisation chamber. A. J. E. W.

Name for element 85. C. W. Martin (*Nature*, 1943, 151, 309).—The name leptine is suggested. A. A. E.

Nuclear chemistry. R. Fleischmann (*Angew. Chem.*, 1940, 53, 485—498).—A comprehensive review of the subject, dealing with nuclear transformation reactions, the energy relationships in nuclear reactions, artificial radioactivity, nuclear isomerism, accurate nuclear masses, and nuclear forces. A summary of applications of nuclear chemistry is also given. A. J. M.

Structure of atomic nuclei. M. F. Soonawala (*Indian J. Physics*, 1942, 16, 291—305).—Mathematical. The possibility of at. nuclei consisting of smaller nuclei of comparable mass, held together by exchange particles, is discussed. The mass and charge of such exchange particles are calc. for a no. of elements. The nuclear spins of He, Ne, Ar, Kr, and Xe are calc. as 0, 1, 1, $\frac{1}{2}$, and $\frac{3}{2}$, respectively. L. J. J.

Analysis of nuclear binding energies. V. Vand (*Phil. Mag.*, 1943, [vii], 34, 280—285).—Calculation of Wigner's $L(A)$ function shows that it is probably not a smooth function of A , owing to the higher proton content of the most abundant nuclei in comparison with that of the most stable ones. L. J. J.

Rational electrodynamics. IV. The "radius" of a point charge. V. The neutron and nuclear dynamics. E. A. Milne (*Phil. Mag.*, 1943, [vii], 34, 235—245, 246—258).—IV. Mathematical.

V. The interaction of two equal point charges of opposite sign is discussed for the case in which one particle is much more massive than the other. L. J. J.

Simplified derivation of the Bohr atom. L. S. Guss (*J. Chem. Educ.*, 1942, 19, 371). L. S. T.

Periodic system of the elements. F. Kipp (*Naturwiss.*, 1942, 30, 679—683).—A new form of the periodic table (a flat, lemniscate 141 F (A., I.)

spiral along which the elements are arranged in order of at. no.) is described and discussed. A. J. E. W.

Motion of gases in the sun's atmosphere. IV. Occurrence of highly stripped atoms in the corona. A. K. Das and Y. P. Rao (*Indian J. Physics*, 1942, 16, 277—289).—The velocity of emitting coronal particles, calc. from line-widths, is ~ 32 km. per sec., inconsistent with thermal equilibrium, while the highly-ionised heavy emitting atoms postulated by Edlén are inconsistent with ionisation equilibrium. Assuming the origin of coronal matter to be in the sun's core, crit. velocities are calc. for which equilibrium is not established in convection. The crit. velocity for a depth 26,000 km. below the photosphere, at which Fe loses 14 electrons, is ~ 300 km. per sec. L. J. J.

II.—MOLECULAR STRUCTURE.

Bond integrals and spectra. R. S. Mulliken and C. A. Rieke (*Rev. Mod. Physics*, 1942, 14, 259).—Results of the use of the mol. orbital method in obtaining relationships between spectra, dissociation energies, and resonance energies are briefly reviewed. A. J. M.

Infra-red spectrum of triatomic molecules. E. F. Barker (*Rev. Mod. Physics*, 1942, 14, 198—203).—The infra-red spectra of SO₂, H₂O, HCN, CO₂, and N₂O are reviewed and discussed. A. J. M.

Infra-red investigation of hydrogen links. H. Hoyer (*Z. physikal. Chem.*, 1940, B, 45, 389—410).—An apparatus for the investigation of short- λ infra-red absorption spectra in the non-photographic region (1.3—2.7 μ) is described. The absorption spectra of *o*-NO₂-C₆H₄-OH (I), *o*-OH-C₆H₄-CO₂Me (II), and *o*-OH-C₆H₄-CO₂Et, and the corresponding heavy compounds with D in the OH, have been investigated, in order to determine the first overtone of the valency vibration of the OH. The differences in the extinctions of the similar normal and heavy mols. were also determined in the above-mentioned range. The first overtone of the H linking is at 1.65 μ . Two combination vibrations of the OH groups of (I) and (II) were found. A. J. M.

Overtone and complex frequencies in the hydrazine spectrum. S. S. Krivitsch (*J. Phys. Chem. Russ.*, 1941, 15, 739—747).—The infra-red (λ 1—5.5 μ) absorption spectrum of N₂H₄ vapour contains 12, and of liquid N₂H₄ 9, complex frequencies, explained as being due to combinations of effects due separately to each NH₂-group. R. T.

Absorption spectra of halogen solutions at low temperatures.—See A., 1943, I, 87.

Spectra of ions in fields of various symmetry in crystals and solutions. S. Freed (*Rev. Mod. Physics*, 1942, 14, 105—111).—The variation of spectra of solutions of Eu⁺⁺⁺ salts when the acid radical is changed is discussed. Bethe's theory on the no. of symmetry characteristics of the component levels which arise from a given energy level of an atom when it is embedded in fields of various crystallographic symmetries is substantiated in the case of EuF₃. Coupling with group and lattice oscillations is discussed. A. J. M.

Calculation of absorption spectra of Wurster's salts. M. G. Mayer and K. J. McCallum (*Rev. Mod. Physics*, 1942, 14, 248—258).—Wurster's salts, which occur in the oxidation of the *p*-phenylenediamines, show a strong absorption in the visible. The lower energy levels of the radicals are calc. by forming completely antisymmetric products of mol. orbitals and taking into account the interaction of those products which have the same symmetry. The frequency and intensity obtained are in good agreement with experiment. The calc. intensity corresponds to an electron no. of ~ 0.3 and the observed val. to ~ 0.1 . The doublet nature of the band is attributed to vibrational splitting. The shift of the band to longer $\lambda\lambda$, and intensification on substitution of Me on the N, are explained qualitatively. A. J. M.

Rotational structure of the near ultra-violet bands of benzene. A. Turkevich and M. Fred (*Rev. Mod. Physics*, 1942, 14, 246—247).—The absorption system of C₆H₆ between 2300 and 2800 Å. has been investigated and analysed. A. J. M.

Electronic absorption spectra of benzene and its derivatives. A. L. Sklar (*Rev. Mod. Physics*, 1942, 14, 232—245).—The calculation of 142

the position of electronic absorption bands by Huckel's methods using the Heitler-London and mol. orbital techniques is reviewed. Difficulties in correlating the observed bands with the results of these simplified calculations are considered. The most reliable method of calculating the excited states of org. mols. at present is considered to be that of antisymmetrical mol. orbitals. There is good agreement between the observed long- λ electronic band systems of C_6H_6 and those deduced by this method. The analysis of the 2600 \AA . band in C_6H_6 and mono- and poly-substituted C_6H_6 spectra is considered. The effect of multiple substitutions on the intensity of the band is discussed in the cases where the substituent has no resonating system of its own, and where it produces a migration not too large to be treated by first-order calculations. A. J. M.

Ultra-violet absorption spectra of substituted benzenes. H. Spöner (*Rev. Mod. Physics*, 1942, **14**, 224—231).—The ultra-violet absorption spectra of $PhCl$, PhF , *o*-, *m*-, and *p*- $C_6H_4Cl_2$, and $C_6H_5Cl_3$ are reviewed and discussed. The theory governing the transitions and selection rules is given. A. J. M.

Electron transfer spectra and their photochemical effects. E. Rabinowitch (*Rev. Mod. Physics*, 1942, **14**, 112—131).—The electron transfer spectra (formerly known as electron affinity spectra) of gaseous mols. and crystals, and the spectra of anions and cations and cation-anion complexes in solution, are reviewed. A. J. M.

Fluorescence notation. J. De Ment (*Phil. Mag.*, 1943, [vii], **34**, 212).—The proposed notation is of the form $[A]_{\text{solvent}}^{\lambda}$ = fluorescence colour, λ denoting the wave-length of the exciting light. Thus fluorescence of riboflavin in aq. solution and in the solid state, respectively, excited by light of λ 3650 \AA ., is denoted by $[A]_{H_2O}^{3650}$ = bright green and $[A]_{\text{solid}}^{3650}$ = orange. A. J. E. W.

Fluorescence and phosphorescence of thallium-activated potassium halide phosphors. P. Pringsheim (*Rev. Mod. Physics*, 1942, **14**, 132—138).—When $TlCl$ is dissolved in conc. aq. solutions of halides new selective bands appear in the absorption spectra with peaks at 2470 \AA . for chlorides and 2650 \AA . for bromides. By absorption in these bands a fairly strong fluorescence is excited. Photometric examination of the fluorescence intensity provides a method for the quant. determination of Tl^+ . Although the fluorescence normally increases with increasing $[Cl^-]$ in $NaCl$ or $CaCl_2$ solutions, the fluorescence yield becomes less in KCl solution when $[KCl]$ is $>2M$. Crystals obtained by evaporating KCl or KBr solutions containing a trace of Tl^+ are strongly fluorescent or phosphorescent even when still wet with the solution. Both the colour and the intensity of the fluorescence depend on $[Tl^+]$ in the crystals. KCl - Tl phosphors obtained by crystallisation resemble single-crystal phosphors to some extent, particularly in their excitation spectrum, but differ in respect of duration of afterglow and the shape of the decay curve. The duration of the afterglow with crystals from aq. solution is \ll that of single crystals. The special features of the phosphors are discussed. A. J. M.

Raman effect and change of state: naphthalene. R. Norris (*Proc. Indian Acad. Sci.*, 1942, **16**, A, 250—255).—Change from the solid to liquid state of $C_{10}H_8$ produces changes in the location of the Raman lines, some in one direction and some in the other. Apart from lattice lines all lines appear both in the melt and the solid. Spectra of crystals of $C_{10}H_8$ for different orientations are recorded and discussed. W. R. A.

Raman effect and hydrogen bonds. VI. Chelate compounds. Esters of salicylic acid and their mixtures. G. V. L. N. Murty and T. R. Seshadri (*Proc. Indian Acad. Sci.*, 1942, **16**, A, 244—249).—In the Raman spectra of Me, Et, Bu^a, *iso*- C_5H_{11} , and Ph salicylate a weak line attributable to the unchelated mol. is observed, in addition to the bright line of the C=O group of the chelate structure. This indicates that the esters consist of an equilibrium mixture with the chelate structure predominating. The intramol. H bond is strong because of the extent of lowering of the C=O frequency and the fact that the spectra of mixtures of the Me and Et esters with $CHCl_3$, PhOH, dioxan, and AcOH are unaffected. The chelate bond, therefore, cannot be broken by anionoid and cationoid solvents and salicylates cannot function, as other esters and phenols do, in breaking H bonds. W. R. A.

Raman effect and hydrogen bonds. VII. Carboxylic acids. G. V. L. N. Murty and T. R. Seshadri (*Proc. Indian Acad. Sci.*, 1942, **16**, A, 264—269).—Raman spectra of $EtCO_2H$, HCO_2H , $BzOH$, and $CHPh:CH:CO_2H$ (I) have been studied with the pure acids in the liquid or molten state and solutions in associating and non-associating solvents. $EtCO_2H$, like AcOH, appears to exist in ring and open dimerides and monomerides. In the pure state the ring structure largely predominates but the other two forms increase on dissolution in associating liquids. The mols. in HCO_2H are more complex and it appears that no mol. type having unco-ordinated C=O exists. $BzOH$ and (I) in the molten state and in C_6H_6 give only one C=O line corresponding with ring dimerides, and in fairly dil. solutions in ethers only monomeride-associates containing unco-ordinated C=O exist. W. R. A.

Raman effect. CXII. Free rotation. V. *iso*Butyl and propylene oxide derivatives. O. Ballaus and J. Wagner (*Z. physikal. Chem.*, 1940, **B**, **45**, 272—284).—Raman spectra of propylene oxide, epihydrin alcohol, epi-chloro-, -bromo-, -iodo-, and -cyano-hydrin, epihydrincarboxylic acid, $Bu^{\beta}Cl$, $Bu^{\beta}Br$, and NH_2Bu^{β} have been measured. Spectra of structurally similar compounds of both types are compared. Freedom of rotation is indicated by the appearance of duplicate $\nu\nu$ for the chains. The influence of chain-branching on the vibration spectrum is discussed. W. R. A.

Raman effect. CXIII. Free rotation. VI. *n*- and *iso*-Propyl derivatives. G. Rädinger and H. Wittek (*Z. physikal. Chem.*, 1940, **B**, **45**, 329—340).—The Raman spectra of Pr^aX and Pr^bX ($X = NH_2, OH, Me, SH, Cl, Br, I$) have been obtained as completely as possible by collecting relevant data, and repetition of some observations. The polarisation has been determined in the case of 6 Pr^a and 5 Pr^b derivatives. A preliminary assignation to the chain vibrations is attempted. A. J. M.

Raman effect. CXIV. Free rotation. VII. Methylated methane derivatives with a branched chain. J. Wagner (*Z. physikal. Chem.*, 1940, **B**, **45**, 341—360).—Polarisation determinations with CMe_2X_2 ($X = Cl, Br$), $Bu^{\gamma}X$ ($X = OH, Cl, Br$), and $CMeCl_3$ (I) have been carried out. The valency force formulæ for the chain CMe_2X of the Pr^b compounds Pr^bX have been derived. The spectra of (I) and the Pr^b , $CH_2:CH\cdot$, Bu^{γ} , and CMe_2 derivatives have been analysed and the spectral transitions in the various radicals and in $CMe_4 \rightarrow CCl_4$ are discussed. A. J. M.

Raman spectra. CX. Nitrogen compounds. XVII. Thioacetamide and thiocarbamide. K. W. F. Kohlrausch and J. Wagner (*Z. physikal. Chem.*, 1940, **B**, **45**, 229—236).—Raman spectra of cryst. $MeCS\cdot NH_2$ (I) and $CS(NH_2)_2$ (II) and six Me derivatives of the latter have been measured. The absence of the SH ν at $\sim 2570\text{ cm}^{-1}$ indicates that the "*iso*" form $CR:NH\cdot SH$ does not exist. Only in $NNN'S$ -tetramethylisothiocarbamide was a strong C=N frequency observed. From comparison with recorded data on similar types and calculations based on models it is concluded that (I) has the amide structure, whereas (II) has the zwitterion structure. W. R. A.

Normal vibrations and the configuration of hydrazine. III. Raman spectrum of hydrazine. J. Goubeau (*Z. physikal. Chem.*, 1940, **B**, **45**, 237—248).—Examination of the Raman spectrum of N_2H_4 at different temp. and with different exciting lines has revealed new lines, some of which agree with infra-red bands, whilst the others must be attributed to mol. association in N_2H_4 . By studying the temp.-dependence of the $\nu\nu$ and their positions in N_2H_4 , H_2O and aq. solutions, the influence of association on the vibrations has been determined. W. R. A.

Raman spectrum of sulphur under high dispersion. R. Norris (*Proc. Indian Acad. Sci.*, 1942, **16**, A, 287—289).—The Raman spectrum of rhombic S shows that lines of low frequency have considerable breadth. W. R. A.

Structural effects of unsaturation and hyperconjugation in aldehydes, nitriles, and chlorides as shown by their dipole moments in the vapour state. E. C. Hurdis and C. P. Smyth (*J. Amer. Chem. Soc.*, 1943, **65**, 89—96).—Dipole moments of vapours of CH_2O , $MeCHO$, $EtCHO$, $PrCHO$, $CHMe:CH:CHO$, diketene, propio-, acrylo-, and crotono-nitrile, and *isocrotyl* chloride have been calc. from dielectric consts. The moment of the C=O bond has been recalcd. and its inductive effect in aldehydes and ketones is examined. Both in behaviour and in structure unsaturated aldehydes, nitriles, and chlorides are closely analogous. Resonance and hyperconjugation have large effects on μ and these variations indicate qualitatively the relative stabilities of various polar structures proposed as contributory to the mol. structure. W. R. A.

Dielectric losses in photo-electric conductivity. J. A. Sikorski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 35—36).—A Lecher wire system and oscillator operating at $\lambda = \sim 400\text{ cm}$. have been used to determine the dependence of dielectric loss angle (δ) on the incident light intensity (I) in $NaCl$ irradiated with X-rays, additively coloured KI, and polycryst. S. In each case $\sin \delta$ increases linearly with I . The results for S show that a positive effect is obtained in idiochromatic as well as allochromatic crystals. A. J. E. W.

Intramolecular hydrogen bond in glyoxaline. G. V. Tzitzischvili (*J. Phys. Chem. Russ.*, 1941, **15**, 1082—1086).—A model of glyoxaline is worked out. The mobile H cannot be fixed between the two N atoms; it vibrates between a position about 1.1 \AA . from one N and a symmetrical position near the other N, and there are 10^{13} vibrations per sec. J. J. B.

Sedimentation behaviour of cellulose nitrate fractions in relation to their molecular form. H. Mosimann (*Helv. Chim. Acta*, 1943, **26**, 61—75).—The sedimentation consts. (s) of five fractions of cellulose nitrate (I) (mol. wt. 6,000—600,000) dissolved in $COMe_2$, $MeOH$, $C_5H_{11}OAc$, and *cyclohexanol* decreased with increase in concn. and with decrease in mol. wt. of (I). There was little difference between the vals. of s in the four solvents. The data are discussed in conjunction with available X-ray interference, η , and streaming

double refraction data. With increasing mol. wt. (I) mols. change from a stretched chain to an irregular although not a coiled form.

C. R. H.

Calculation of ionic radii from entropies. A. F. Kapustinski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 59—61).—The following mean ionic radii (r) are derived by calculation from S data and comparison with vals. deduced by other methods: Cu^{++} 0.82 ± 0.02 , Sn^{++} 1.02 ± 0.02 , NH_4^+ 1.40 ± 0.03 , OH^- 1.40 ± 0.1 Å. S data alone give Hg_2^{++} 2.19 ± 0.30 , ClO_4^- 3.37 Å., the latter val. being of doubtful accuracy. S vals. for $[\text{Co}(\text{NH}_3)_6]^{++}$ and $[\text{Ni}(\text{NH}_3)_6]^{++}$, calc. from r (2.60 , 2.58 Å.), are 22.0 and 21.8 units, respectively. A. J. E. W.

Parachors and molecular diameters. M. S. Telang (*Current Sci.*, 1943, 12, 19—20).—The equation $\sigma = 0.933 \times 10^{-4} P^{1/3} (1 - T_c)^{2/3}$ cm. (σ = mol. diameter) is applicable to normal liquids over a wide range of temp., and has been applied to C_6H_6 , PhCl , and CCl_4 . W. R. A.

Parachor and latent heat of vaporisation.—See A., 1943, I, 149.

III.—CRYSTAL STRUCTURE.

Construction of reciprocal space-lattice from Debye-Scherrer diagrams. M. Straumanis (*Z. Krist.*, 1942, 104, 167—177).—The method described applies to cubic crystals. A. J. M.

Structure of calcium peroxide. V. Kotov and S. Raichstein (*J. Phys. Chem. Russ.*, 1941, 15, 1057—1058).—The space-group of CaO_2 is D_{2h}^{12} ; a 5.01 , c 5.92 Å. ρ from X-ray spacings is 3.20 , and from pycnometer data 2.92 . J. J. B.

Crystal structure of $\text{Al}_3\text{Si}_2\text{Mg}_2\text{Fe}$. H. Perlitz and A. Westgren (*Arkiv Kemi, Min., Geol.*, 1942, 15, B. No. 16, 8 pp.).—This substance is present in Al alloys of composition Al 81, Si 12, Mg 6, Fe 0.22% ; ρ 2.52 ; space-group D_{2h}^{12} — $C62$ m. The arrangement of atoms in the lattice is given, and interat. distances are calc. A. J. M.

X-Ray investigation of titanium carbide. J. S. Umanski and S. S. Chidekel (*J. Phys. Chem. Russ.*, 1941, 15, 983—996).—Carbides prepared from TiO_2 in H_2 (I) contain 11—19% or in vac. (II) 10—20% of bound C, and carbides made from Ti hydride in vac. (III) contain 9—10% of bound C. The X-ray spacing increases from 4.294 Å. to 4.320 Å. when the C content rises from 9% to 20%. The intensity distribution of the lines shows that (I) contains O equiv. to the deficit of C, (II) contains about as many holes in the lattice as O atoms, and (III) 5—8 holes for one O atom. J. J. B.

X-Ray investigation of complex titanium tungsten carbides. J. S. Umanski and S. S. Chidekel (*J. Phys. Chem. Russ.*, 1941, 15, 997—1004).—The spacing of TiC containing nearly the theoretical amount of C is reduced by WC. 1 part of TiC dissolves at $1500^\circ \sim 2.6$ and at $2700^\circ \sim 30$ parts of WC; at still larger additions of WC the unchanged spacing of WC appears, showing that WC does not dissolve TiC. The spacings of mixtures of WC with TiC containing <50 at.-% of C are, for $>60\%$ of WC, identical with those of mixtures made with pure TiC, since WC reacts with Ti oxides to form W_2C and TiC. No compound $\text{W}_2\text{Ti}_3\text{C}_4$ was observed. J. J. B.

Crystal structure of potassium hydroxystannate and related compounds. C. O. Björling (*Arkiv Kemi, Min., Geol.*, 1942, 15, B. No. 2, 6 pp.).—The crystal structure of the isomorphous compounds $\text{K}_2\text{Sn}(\text{OH})_6$, $\text{Na}_2\text{Sn}(\text{OH})_6$, and $\text{K}_2\text{Pt}(\text{OH})_6$ has been investigated; they have a 5.65 , 5.84 , 5.65 Å. and a 70.1° , 61.2° , and 62.0° , respectively. Space-group C_{2h}^2 — $R\bar{3}$; 1 mol. per unit cell. $\text{K}_2\text{Sn}(\text{OH})_6$ forms a layer lattice, resembling that of brucite, $\text{Mg}(\text{OH})_2$, and $\text{Ca}(\text{OH})_2$, and not a distorted K_2PtCl_6 structure. A. J. M.

X-Ray study of monetites and related compounds. E. Bengtsson (*Arkiv Kemi, Min., Geol.*, 1942, 15, B. No. 7, 8 pp.).—The structures of BaPO_3F , BaRbPO_3 , BaHPO_3 (Ba monetite), PbHPO_3 (Pb monetite), and RbHSO_4 have been determined. The monetites were prepared artificially. The space-group of BaHPO_3 is D_{2h}^{12} — Pbm , and that of PbHPO_3 is C_{2h}^2 — $P2_1/c$ or C_2^2 . The unit cell of RbHSO_4 is orthorhombic, space-group D_{2h}^{12} — $Abmn$. A. J. M.

Lattice parameters of cubic As_2O_3 and Sb_2O_3 . K. E. Almin and A. Westgren (*Arkiv Kemi, Min., Geol.*, 1942, 15, B. No. 22, 6 pp.; cf. Bozorth, A., 1923, ii, 632).—X-Ray powder photographs give for As_2O_3 a 11.05 Å., and for Sb_2O_3 11.13 Å. The parameters x and y for As_2O_3 are -0.103 ± 0.001 and 0.175 ± 0.010 , respectively, and for Sb_2O_3 they are -0.115 ± 0.001 and 0.190 ± 0.015 , respectively. In solid As_2O_3 the As—As distance is 3.23 ± 0.01 Å., and As—O is 1.90 ± 0.05 Å.; Sb—O is 2.0 ± 0.1 Å. The shortest O—O distances from mol. to mol. are 3.00 ± 0.05 Å. for As_2O_3 , and 2.86 ± 0.04 Å. for Sb_2O_3 . A. J. M.

X-Ray studies on potassium antimonates. P. Spiegelberg (*Arkiv Kemi, Min., Geol.*, 1940, 14, A. No. 5, 12 pp.).— KSbO_3 , by heating Sb_2O_3 — KOH , $\text{KSb}(\text{OH})_6$, or Sb —excess of KNO_3 is isomorphous with ilmenite, has a 6.814 Å., α $46^\circ 20'$, and gives on prolonged heating (3 weeks at 1000°) cubic KSbO_3 (space-group $P\bar{3}$). The unit cell (12 mols.; edge 9.56 Å.) is built up of K^+ ions and Sb_2O_3 groups,

two Sb—O octahedra being joined along one edge by two shared O atoms. SbCl_3 — K_2CO_3 (also KSbO_3 — Sb_2O_3) at red heat give the orthorhombic compound $\text{K}_2\text{Sb}_2\text{O}_7$ (space-group Pca or $Pcma$), the structure of which could not be determined. M. H. M. A.

Crystal structure of zinc metantimonate and similar compounds. A. Byström, B. Hök, and B. Mason (*Arkiv Kemi, Min., Geol.*, 1942, 15, B. No. 4, 8 pp.).—The crystal structures of ZnSb_2O_6 , MgSb_2O_6 , FeSb_2O_6 , CoSb_2O_6 , NiSb_2O_6 , MgTa_2O_6 , FeTa_2O_6 , CoTa_2O_6 , NiTa_2O_6 , and CuSb_2O_6 have been determined. All except the last have a trirutile structure, with space-group $P4_{2/m}$, but CuSb_2O_6 has a monoclinic, deformed trirutile structure, with space-group $P2_1/c$. Vals. of a and c are given for each compound. A. J. M.

Crystal structure of lead metantimonate and isomorphous compounds. A. Magnéli (*Arkiv Kemi, Min., Geol.*, 1942, 15, B. No. 3, 6 pp.).—The crystal structures of CaSb_2O_6 , SrSb_2O_6 , BaSb_2O_6 , CdSb_2O_6 , HgSb_2O_6 , PbSb_2O_6 , CaAs_2O_6 , SrAs_2O_6 , CdAs_2O_6 , HgAs_2O_6 , PbAs_2O_6 , and CoAs_2O_6 , all of which are isomorphous, have been investigated. The space-group is D_{2h}^{12} — $C312$; 1 mol. per unit cell. The structure is composed of layers of $(\text{Sb}_2\text{O}_6)^{--}$, formed of coupled SbO_4 octahedra, between which the cations are inserted. This is in agreement with the fact that in the series of compounds, a varies little, and c greatly. A. J. M.

Crystal structure of Arppe's bismuth oxychloride, $\text{Bi}_2\text{O}_3\text{Cl}_2$, and the isomorphous oxybromide ("step-lattice oxyhalides"). L. G. Sillén and M. Edstrand (*Z. Krist.*, 1942, 104, 173—196).—When BiOCl and BiOBr are heated above 700° , new oxyhalides are formed. The oxychloride is Arppe's compound. Both are monoclinic. The formula $\text{Bi}_2\text{O}_3\text{X}_2$ ($\text{X} = \text{Cl}, \text{Br}$) is obtained by analysis, ρ , and X-ray analysis. The X-ray structure indicates the existence of plane metal—O sheets, and single halogen sheets in a step-like arrangement, although small disagreements in the intensities are observed, which are ascribed to slight displacements from the ideal positions. A. J. M.

Inorganic salts with a homogeneity range. Tantalates (and niobates). F. Halla, A. Neth, and F. Windmaisser (*Z. Krist.*, 1942, 104, 161—166).—The dimensions of the elementary cell, ρ , and space-groups of the two isomorphous salts $4\text{K}_2\text{O} \cdot 3\text{M}_2\text{O}_5 \cdot 16\text{H}_2\text{O}$ ($\text{M} = \text{Nb}, \text{Ta}$) and of $7\text{K}_2\text{O} \cdot 6\text{Nb}_2\text{O}_5 \cdot 27\text{H}_2\text{O}$ have been determined. Formulae of tantalates and niobates reported in the literature do not always agree with the above because the salts are not of const. composition but have a range of homogeneity. A. J. M.

Molecular structure of ozone. W. Shand, jun., and R. A. Spurr (*J. Amer. Chem. Soc.*, 1943, 65, 179—181).—By electron diffraction investigations the O_3 mol. is an isosceles triangle, with the O—O linking 1.26 ± 0.02 Å. and the O—O—O angle $127 \pm 3^\circ$. W. R. A.

X-Ray analysis of potassium perchromate, K_2CrO_8 , and isomorphous compounds. I. A. Wilson (*Arkiv Kemi, Min., Geol.*, 1942, 15, B. No. 5, 7 pp.).—The structures of K_2CrO_8 , K_2NbO_8 , K_2TaO_8 , Rb_2TaO_8 , and Cs_2TaO_8 have been determined. The compounds are isomorphous, with space-group $I\bar{4}2m$; 2 mols. per unit cell. The O—O bond in K_2CrO_8 has a length of 1.34 ± 0.06 Å. A. J. M.

Structure of the 12-hetero-poly-compounds. H. O'Daniel (*Z. Krist.*, 1942, 104, 225—227).—The structures of 1-phospho-12-tungstic acid, $\text{H}_3[\text{P}(\text{W}_2\text{O}_{10})_4]$, and similar compounds, put forward by Keggin (cf. A., 1934, 479) and by Jahr (*Naturwiss.*, 1941, 29, 505, 528) are discussed and compared. A. J. M.

Anomalous mixed crystals. V. Anomalous mixed system potassium sulphate—Ponceau-red. A. Neuhaus (*Z. Krist.*, 1942, 104, 197—224).—The crystal structure of the mixed crystal system K_2SO_4 —Ponceau-red (I) has been investigated by macro-methods and X-ray and optical methods. The crystals of the K salt corresponding with (I), $\text{K}_2\text{C}_{12}\text{H}_{12}\text{O}_7\text{N}_2\text{S}_2 \cdot 7\text{H}_2\text{O}$, are rhombic; symmetry $C_{2h} = 2m$. (I) itself is monoclinic. The morphology of crystals of both compounds is given, together with the pleochroism, and lattice consts. The b -axis of the (I) crystal is oriented parallel to the c -axis of K_2SO_4 . A. J. M.

Structure of multilayers and the relation between optical and mechanical thickness and X-ray spacing. E. Stenhagen (*Arkiv Kemi, Min., Geol.*, 1941, 14, A. No. 11, 12 pp.).—It is pointed out that agreement cannot be expected between the optically measured thickness and the long X-ray spacing of multilayers transferred to solid surfaces. When films are first deposited they may stretch across the grooves in the solid substrate or follow the surface contours according to the piston pressure during deposition. Subsequently an oriented crystallisation occurs with resultant change in the X-ray spacings, whilst the optical thickness may remain unchanged. J. W. S.

Electron diffraction study of cadmium chloride. S. G. Pinsker and L. I. Tatarinova (*J. Phys. Chem. Russ.*, 1941, 15, 1005—1010).—Thin films of CdCl_2 crystallise in the space-group D_{2h}^{12} and have a 3.85 , c 17.46 Å. J. J. B.

Diffraction of rapid electrons in thin films of cellulose ethers and esters. V. A. Kargin and D. I. Leipunskaya (*J. Phys. Chem. Russ.*, 1941, 15, 1011—1021).—With 35—40-kv. electrons spacings of

1.11—1.18 and 2.00—2.07 Å. are found for all cellulose derivatives. A third spacing is 4.4—4.6 Å. for cellulose hydrate (I), colloxylin, benzylcellulose, and cellulose stearate; it is 3.7—3.8 Å. for cellulose triacetate (II) and for cellulose regenerated from (II). It is assumed that in (I) the glucose rings of a cellobiose mol. are in one plane, and in (II), in planes inclined at $\sim 90^\circ$. All cellulose derivatives are amorphous. J. J. B.

Theory of the irreversible electrical resistance changes of metallic films evaporated in vacuum. V. Vand (*Proc. Physical Soc.*, 1943, 55, 222—246).—Mathematical. The characteristic irreversible changes shown by metallic films prepared by evaporation, especially at low temp., can be explained by a decay of lattice distortions. A treatment based on simplifying assumptions and involving the distribution of decay energies initiating decomp. of distortions is developed, and discussed with reference to available data. N. M. B.

Volume rectification of crystals. B. K. Sen (*Indian J. Physics*, 1942, 16, 329—335).—Vol. rectification has been demonstrated in PbS, FeS₂, and MnO₂ crystals, which have centres of symmetry. The effect may not take place within the body of the crystal but may be a differential effect of surface rectification at the two large electrode contacts. L. J. J.

Structure and properties of diamond. (Sir) C. V. Raman (*Current Sci.*, 1943, 12, 33—42).—An address. W. R. A.

Crystal structure of pond ice observed with polaroid spectacles. W. S. von Arx (*J. Chem. Educ.*, 1942, 19, 478—479). L. S. T.

Optical crystallographic studies with the polarising microscope. IV. Axial dispersion with change of sign. Dispersion measurements. W. M. D. Bryant. V. Ellipsoidal dispersion in the picrates of various amines. J. Mitchell, jun., and W. M. D. Bryant (*J. Amer. Chem. Soc.*, 1943, 65, 96—102, 128—137).—IV. The dispersion of the optic axial angle in *trans*-stilbene (I) has been measured. (I) is optically positive at >4070 Å. and optically negative at <4070 Å.; this rare type of dispersion is called axial dispersion with change of sign. Strong crossed dispersion is also present. Dispersions of the refractive indices α , β , and γ of (I) and the indices ϵ and ω of benzil have been measured. CS(NH₂)₂ has also been investigated and displays crossed axial plane dispersion near 3780 Å.

V. The optic axial angle $2H$ and dispersion of picric acid and 32 picrates of amines have been measured monochromatically at $\lambda\lambda$ between 6908 Å. and the limit of transmission in the blue. The types of dispersion exhibited are classified. The principal refractive indices, α , β , and γ , and other optical properties have been determined for the 5461 Å. Hg line. The optic axial angles of the picrates of NH₂Pr^a, NPr^a₃, and guanidine have been measured photographically in the near infra-red. Red NH₄ picrate is not a distinct polymorph, but a slightly contaminated form of the yellow salt. W. R. A.

Scattering of light in single-crystals. S. Bhagavantam and J. V. Narayana (*Proc. Indian Acad. Sci.*, 1942, 16, A, 366—368).—Measurements of intensity and depolarisation factors of Rayleigh scattering in cut and single polished crystals of quartz and calcite have been made with reference to directional excitation; the results agree qualitatively with the theoretical predictions of Matossi. W. R. A.

Optical behaviour of non-ideal crystalline lattices in the infra-red. I. Lifschitz (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 37—39).—A preliminary theoretical treatment of the influence of perturbations in translational symmetry, such as those introduced by isotopic atoms in a lattice, on optical properties in the infra-red is outlined. General conclusions relating to absorption at different $\nu\nu$ and changes in resonance $\nu\nu$ are stated. A. J. E. W.

Force constants and normal modes of the totally symmetric vibrations in α -quartz at room temperature. B. D. Saksena (*Proc. Indian Acad. Sci.*, 1942, 16, A, 270—277).—Force consts. for α -quartz have been calc. with the help of the four vibrational $\nu\nu$ belonging to the totally symmetric class. W. R. A.

Photo-elastic effect in crystals. S. Bhagavantam (*Proc. Indian Acad. Sci.*, 1942, 16, A, 359—365).—Theoretical. A method, based on the theory of groups, for obtaining the no. of optical, elastic, and stress-optical coeffs. for the 32 classes of crystals is given. W. R. A.

Melting in single-crystal tungsten wires. I. N. Stranski and R. Suhrmann (*Naturwiss.*, 1942, 30, 662).—Peculiar kinks have been observed in the fragments of 0.1-mm. single-crystal W wires burnt through by overheating. They are attributed to gliding effects along (001) planes, which cause lattice faults resulting in a localised increase of resistance and consequent melting; the molten W is squeezed outwards by compressive stress in the wire, and the cross-section is thus increased; the temp. then falls and the W resolidifies. The kinks are not obtained in drawn W wires, in which glide-plane faults do not occur. A. J. E. W.

X-Ray evidence for a third polymorphic form of sodium stearate. A. de Bretteville, jun., and J. W. McBain (*Science*, 1942, 96, 470—471).—The new (γ) form was obtained from stearic acid (Eastman

catalogue no. 402) and NaOEt, and dried at 105°. The long spacing is 44.6 Å. (α -form, 51.8 Å.; β -form 46.6 Å.). E. R. K.

IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

Peculiarities of the physical properties of "high polymers." V. A. Kargin and G. L. Slonimski (*J. Phys. Chem. Russ.*, 1941, 15, 1022—1028).—Physical properties of polymers depend on the mobility of their chains (long relaxation time) and of the single links in the chains (short relaxation time). It is predicted that the m.p. of polymers will show a max. at a medium mol. wt. J. J. B.

Electrical conductivity of beryllia and magnesia at high temperatures. M. Foëx (*Compt. rend.*, 1942, 214, 665—666).—Resistivity (r) data for BeO and MgO at $>2100^\circ$ are recorded. They follow approx. the law $r = Ae^{-B/T}$. Traces of SiO₂ or H₂O markedly diminish r for MgO. F. J. G.

Hysteresis in pure superconducting metals. N. E. Alexeevski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 32, 31—34).—Experiments are described which show that macroscopic currents are established in a disc or hollow cylinder during the transition from the normal to the superconducting state. These currents circulate in a circumferential zone and maintain the remainder of the conductor in the normal or intermediate state; they are produced by eddy current effects. "Frozen" fields in hollow superconductors and hysteresis effects in the conducting-superconducting transition are explained. A. J. E. W.

Influence of ultrasonic waves on the magnetic behaviour of nickel. III. Ferrograph measurements on nickel wires. G. Schmid and U. Jetter (*Z. Elektrochem.*, 1942, 48, 513—522).—With max. field strength (H) 0.084 or 1.0 oersted the magnetisation curves of annealed Ni wires are strongly displaced by low intensities of ultrasonic waves, the max. magnetisation (I_m), coercive power (H_c), and residual magnetisation (I_r) all being increased. This effect attains a max. with wave intensity (P) ~ 1 kg. per sq. mm. and decreases with further increase of P , but even at high vals. of P , I_m is $>$ the val. obtained without the application of ultrasonic waves. A superimposed static stress decreases the magnitude of the effect and displaces the max. effect to higher P . With max. H 50 oersteds increase of P causes a decrease in H_c and I_r , whilst I_m remains almost const. No max. effect is observed. The results are in accord with the author's theory (*ibid.*, 1941, 47, 155). J. W. S.

Adiabatic temperature changes accompanying the magnetisation of iron in low and moderate fields. L. F. Bates and D. R. Healey (*Proc. Physical Soc.*, 1943, 55, 188—202).—A method previously described (cf. A., 1941, I, 33) was applied to the case (presenting exceptional difficulties) of annealed and cold-drawn tempered Armco Fe. A detailed analysis of the energy changes in the several stages of the hysteresis cycle is given. There is evidence of the existence of a kind of discontinuity in the magnetisation of Fe in fields of 350—400 oersteds predicted by Akulov (cf. A., 1931, 791) and hitherto not observed experimentally. N. M. B.

Dispersion of sound velocity in alcohols. G. R. Rendall (*Proc. Indian Acad. Sci.*, 1942, 16, A, 369—378).—Adiabatic compressibilities of MeOH, EtOH, Pr^aOH, Bu^aOH, *iso*-C₆H₁₁OH, and CH₂:CH·CH₂·OH have been measured at different temp., and from these and ρ data the velocities of sound in m. per sec. for each at 25°, 30°, and 35° have been calc. Ultrasonic velocities have been determined at ~ 2000 kc. per sec. For all except Bu^aOH the ultrasonic velocity is $>$ the sonic. All except (probably) Pr^aOH exhibit dispersion. W. R. A.

Scattering of light by liquid surfaces. P. S. Hariharan (*Proc. Indian Acad. Sci.*, 1942, 16, A, 290—293).—Using the objective method of photographic photometry the variations of the intensity of the scattering of light by the surface of liquid MeOH with changes of the azimuth and of the angle of observation have been measured; the results are not in accord with the Mandelstam-Gans theory. W. R. A.

Heat capacities at higher temperatures of ethane and propane. B. P. Dailey [with W. A. Felsing] (*J. Amer. Chem. Soc.*, 1943, 65, 42—44).—Vals. of C_p for air, C₂H₆, and C₃H₈ have been measured calorimetrically over the range 340—700° K. and are compared with theoretical vals. and existing experimental data. W. R. A.

Heat capacities of and hindered rotation in *n*- and *iso*-butane. B. P. Dailey [with W. A. Felsing] (*J. Amer. Chem. Soc.*, 1943, 65, 44—46).—Vals for C_p of *n*- and *iso*-C₄H₁₀ have been determined calorimetrically from 340° to 700° K. C_p of *n*-C₄H₁₀ is slightly $>$ C_p of *iso*-C₄H₁₀ at corresponding temp. The mol. structures are discussed. W. R. A.

Resonance method of measuring the ratio of the specific heats of a gas, C_p/C_v . IV. A. L. Clark and L. Katz (*Canad. J. Res.*, 1943, 21, A, 1—17; cf. A., 1942, I, 232).—A rigorous theoretical treatment of the effect of departure from adiabaticity due to heat exchange between gas and chamber walls is given for spherical and

cylindrical resonance chambers, and applied to the correction of the authors' earlier results. Data for H_2 and He are extended to 60 atm. The corr. vals. obtained for γ are: A (24.2°, 1—20 atm.) $1.6667 + 0.00353P$; He (23.1°, 1—58 atm.) $1.6669 - 0.0002P$; H_2 (24.4°, 1—59 atm.) $1.4045 + 0.00025P$; N_2 (23.0°, 1—26 atm.) $1.4006 + 0.00221P$; CO_2 (23.8°, 1—22 atm.) $1.2948 + 0.00500P + 0.000179P^2$; SO_2 (25.1°, 1.2837 (1 atm.), 1.2642 (0 atm.); N_2O (25.1°) 1.2847 (1 atm.), 1.2783 (0 atm.). Vals. agree with spectroscopic data within 0.01% for monat., 0.05% for diat., and 0.5% for triat. gases. L. J. J.

Development of thermal conductivity methods for measuring molecular heats of very dilute gases by simultaneous determination of accommodation coefficients. A. Eucken and H. Krome (*Z. physikal. Chem.*, 1940, **B**, 45, 175—192).—The theory and technique of thermal conductivity methods of measuring mol. heats of very dil. gases and simultaneous determination of accommodation coeffs. (α) are discussed. Measurements of α for Xe, Kr, A, Ne, N_2 , CO_2 , and H_2O on Pt justify the theoretical and experimental methods. New measurements on H_2O and N_2H_4 vapours show that the vals. of C_v obtained for temp. $>0^\circ$ agree well with vals. calc. from spectroscopic data. Below 0° N_2H_4 associates to double mols. W. R. A.

Heats of vaporisation of hexanes. J. F. Lemons [with W. A. Felsing] (*J. Amer. Chem. Soc.*, 1943, **65**, 46—48).—Vals. of ρ from 0° to the b.p. and heats of vaporisation from 20° to the b.p. have been determined for $n-C_6H_{14}$, Pr^aPr^b , and Pr^b_2 . The heats of vaporisation diminish with increased chain-branching. W. R. A.

Parachor and latent heat of vaporisation. M. S. Telang (*Current Sci.*, 1942, **11**, 461—462).—If l = latent heat of vaporisation, T_b = abs. b.p., $[P]$ = the parachor, D_0 = density of the supercooled liquid at 0° K., and D = density of the liquid at its b.p., then $l = 60.7T_b/[P]D_0$, or, rather less accurately $l = 44T_b/[P]D$. Also $MI = \Delta H_m = 0.818p_c[P]$, where ΔH_m is the molal heat of vaporisation, p_c is the crit. pressure (in atm.), and MI/T_b is the Trouton const. Calc. and observed data for five org. liquids and for $SnCl_4$ are given. N. M. B.

Freezing of normal liquids and liquids with a "fixed" structure, such as rubber and plastics. K. Ueberreiter (*Z. physikal. Chem.*, 1940, **B**, 45, 361—373).—The freezing of liquids is considered from the viewpoint of structure. When a liquid is cooled a region is reached where the velocity of cooling begins to exceed the relaxation time of the structure. The sudden change of direction of the temp.-vol. curve is a useful indication of freezing. This occurs not only with normal liquids, but also with high polymerides. The latter, which are called liquids with a "fixed" structure, freeze at higher temp. owing to the restricted motion of the elementary particles. Variation of η in the freezing region is also considered. A. J. M.

Vapour pressure of the product of reaction between dry sulphur dioxide and nitrogen dioxide. V. V. Illarionov (*J. Phys. Chem. Russ.*, 1941, **15**, 1108—1112).—The v.p. of the compound $(SO_2)_2N_2O_3$ (cf. A., 1942, I, 207) at 130° , 150° , and 208° is 0.95, 2.6, and 22.4 mm., respectively. J. J. B.

Chemical war materials. XXVI. Volatility and persistence. H. Mohler (*Helv. Chim. Acta*, 1943, **26**, 157—161).—The assignment of numerical vals. to volatility and persistence is discussed. In view of the wide limits of volatility within which non-persistent gases lie, that term is considered of little val., a more convenient term being persistence, expressed as the ratio of speed of volatilisation (u) to speed of volatilisation of H_2O . From the simplified formula $u = 58.3p\sqrt{(M/T)}$ g. per sq. m. per sec., where p = v.p. at T° K., and M = mol. wt., it is shown that for non-persistent gases $u > 100$ (generally > 500) and for persistent gases $u < 100$ (generally < 20). The vals. of u for mustard gas, lewisite, diphosgene, CCl_3NO_2 , and H_2O are respectively 5, 20, 500, 750, and 250. C. R. H.

Coefficient of expansion of solids. M. R. Rao (*Current Sci.*, 1942, **11**, 430—431).—The sp. heat theory of Raman leads to an expression for the coeff. of expansion of a crystal, which has been applied to Li from 15° to 280° K. W. R. A.

Liquid state. I. Two-phase diagrams of internal friction. M. Trautz (*Kolloid-Z.*, 1942, **100**, 405—424).—Theoretical. Available T , p , d , and η data for certain liquid-gaseous systems have been collected, criticised, and used to construct phase diagrams as a preliminary step towards developing a theory of the liquid state. C. R. H.

Self-diffusion of copper. M. S. Maier and H. R. Nelson (*Amer. Inst. Min. Met. Eng.*, 1942, *Tech. Publ.* 1419, 8 pp.; *Met. Tech.*, 1942, **9**, No. 1).—The rate of self-diffusion of Cu at 802 — 977° was studied by observing the diffusion of the radioactive isotope ^{64}Cu , which was prepared by deuteron bombardment in a cyclotron and electroplated to a thickness of $\sim 10^{-4}$ cm. on the surface of the specimens. The rate was slightly higher in single-crystals than in polycryst. Cu. If anisotropy of diffusion exists it is small and easily masked by effects due to crystal imperfections. J. C. C.

Intradiffusion coefficient and viscosity of monatomic liquids. K. Schäfer (*Kolloid-Z.*, 1942, **100**, 313—320).—Equations for intra-

diffusion coeff. and η have been derived and applied to data for molten metals. C. R. H.

V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

Scattering of light in binary liquid mixtures. P. S. Hariharan (*Proc. Indian Acad. Sci.*, 1942, **16**, A, 278—282).—Raman's technique (cf. A., 1942, I, 44) is used for studying the reversal of polarisation and ellipticity in $PhOH-H_2O$, CS_2-MeOH , and $MeOH-n-C_6H_{14}$ mixtures. These exhibit elliptic polarisation near the crit. solution temp., but at higher temp. the ellipticity vanishes, indicating a change in the size of the particles. Mol. clusters appear to be formed near the crit. solution temp. and their size decreases with rise in temp. W. R. A.

Intensity of lines of dispersion of combination in solutions of different dilution as function of concentration.—See A., 1943, I, 116.

Critical properties of volatile hydrocarbon mixtures.—See B., 1943, I, 191.

Freezing points, densities, and refractive indices of the system glycerol-ethylene glycol-water. J. A. Spangler, and E. C. H. Davies (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 96—99).—Data are tabulated and represented diagrammatically. L. S. T.

Dipole swarm formation and dielectric polarisation. H. Hartmann (*Naturwiss.*, 1942, **30**, 662).—The theory of dipole swarm formation leads to a new expression for the orientation polarisation of solutions of polar substances in non-polar solvents. In an expanded form the expression corresponds with the empirical relation of van Arkel and Snoek (cf. A., 1932, 983). A. J. E. W.

Activity of exponentially diluted solutions. W. Ludwig (*Naturwiss.*, 1942, **30**, 662—663).—A survey of published work affords no proved experimental evidence for sp. biological effects of very highly diluted solutions, e.g., of $AgNO_3$. A. J. E. W.

Physical effects of exponentially diluted substances at very low concentrations. E. Heintz [with Fleischmann and Beischer] (*Naturwiss.*, 1942, **30**, 642; cf. A., 1942, I, 393).—New infra-red absorption and electrical conductivity measurements on solutions of inorg. salts, with more refined technique, have failed to confirm the effects previously reported. A. J. E. W.

Isopiestic measurements in dilute solutions. System potassium chloride-sodium chloride at 25° at concentrations from 0.03 to 0.10M. A. R. Gordon (*J. Amer. Chem. Soc.*, 1943, **65**, 221—224).—An isopiestic method for investigating 1:1-electrolytes at low concns. ($< 0.03M$) is described. The slowness of attaining equilibrium is attributed to the rate of transport of solvent in the vapour phase rather than to the rate of heat transfer from one solution to the other. Results for $KCl-NaCl$ (0.03—0.10M.) agree well with e.m.f. data. W. R. A.

Diffusion coefficient of Ilković's equation. A. M. Zanko and B. A. Geller (*J. Phys. Chem. Russ.*, 1941, **15**, 797—806).—The diffusion coeff. of ions (Cd and Tl') cannot be derived from Nernst's ionic mobility equation, but must be derived empirically in each case. For this purpose the polarographic and electrolytic methods may be used. R. T.

Cryoscopy. V. Aqueous solutions of alkali bromates and iodates. VI. Aqueous solutions of mixtures of strong electrolytes. L. Cavallaro (*Gazzetta*, 1942, **72**, 215—221, 222—232).—V. Cryoscopic data for aq. $NaBrO_3$, $NaIO_3$, $KBrO_3$, and KIO_3 are shown to agree with the vals. calc. by Bonino's formula, whilst with increase in concn. the data diverge from the vals. calc. by the Debye-Hückel theory.

VI. Data for aq. $KCl-NaCl$ and $NaCl-NaClO_3$ are tabulated. Accepting the coeff. of activity given by application of the Debye-Hückel and Bonino theories, these data indicate that the only interaction of the ions is electrostatic. The proportionate ratio between the cryoscopic data for the mixtures and those calc. from the equiv. single solutions is unity for $KCl-NaCl$ mixtures, whilst that for $NaCl-NaClO_3$ mixtures deviates from unity (max. deviation with the 1:1 mixture), possibly owing to complex formation and disturbance of the ClO_3' grouping by high $[Cl^-]$. F. O. H.

Energetics of alloy formation. O. Kubaschewski (*Z. Elektrochem.*, 1942, **48**, 559—582).—A review of recent experimental methods for the determination of the heat and free energy change in the formation of alloys, the determination of m.p. and transition points, and the data which have been obtained by these methods. J. W. S.

Constitution of copper-rich copper-silicon-manganese alloys. C. S. Smith and W. R. Hibbard (*Amer. Inst. Min. Met. Eng.*, 1942, *Tech. Publ.*, 1418, 4 pp.; *Met. Tech.*, 1942, **9**, No. 1).—The boundaries of the Cu-Si κ phase, overlooked in previous work (cf. B., 1930, 615), have been established by the micro-examination of quenched specimens etched with a solution containing H_2O_2 (30 vol.) 20, H_2O 25, 20% aq. KOH 5, aq. NH_3 (d 0.90) 50 c.c. The position of the α boundary at 300° and 350° has been determined by measurements of electrical conductivity. J. C. C.

The ferromagnetic nature of the beta phase in the copper-manganese-tin system. L. A. Carapella and R. Hultgren (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1405, 10 pp.; *Met. Tech.*, 1941, 8, No. 7).—X-Ray diffraction methods were used to establish the extent of the β phase region in powder samples prepared from alloys melted in pure Al_2O_3 crucibles under A. The β phase is stable only above $\sim 625^\circ$ but is retained by quenching. Alloys in the β region containing >20 at.-% of Mn have an ordered structure, are generally brittle, and have high vals. of magnetic saturation. Measurements of magnetic susceptibility were made on quenched powdered samples with a modified Fereday magnetometer at 25° and in liquid N_2 . Ageing at 200° generally causes an increase in magnetisability followed after longer periods by a decrease. Ferromagnetism appears to be closely related to degree of ordering, the max. val. of magnetic saturation of 76.65 ergs per gauss per g. (for $I_0 = 660$) being reached with the ideally ordered composition Cu_2MnSn . J. C. C.

Magnetic studies on the precipitation of iron in α - and β -brass. C. S. Smith (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1394, 11 pp.; *Met. Tech.*, 1941, 8, No. 8).—Measurements of magnetic remanence indicate that Fe in excess of 0.03% is slowly pptd. as a non-magnetic phase when 70:30 brass, quenched from 800° , is reheated at 400 – 500° for 2–1500 hr. Brass with this pptd. phase becomes ferro-magnetic when cold-worked. Pptn. is most rapid in samples H_2O -quenched from 800° ; it becomes progressively slower as the quenching temp. is reduced, although the alloys are definitely homogeneous when quenched. When 53:47 β -brass containing $<0.3\%$ of Fe is quenched from the solid solution range it is ferro-magnetic and its remanence is reduced by low-temp. annealing. However, β -brass containing $<0.2\%$ of Fe is non-magnetic when quenched but becomes ferro-magnetic after low-temp. annealing for a short period. The remanence of reheated β -brass is not affected by cold-working. J. C. C.

Limited mutual solubility of gases at high pressures. I. R. Kritschewski and D. S. Ziklis (*J. Phys. Chem. Russ.*, 1941, 15, 1059).—The solubility of N_2 in NH_3 (cf. A., 1941, I, 415) is measured at 125 – 148° and 5000–9500 kg. per sq. cm. J. J. B.

Lead chloride-ethylene glycol-water system at 25° . A. B. Garrett, M. V. Noble, G. Kiefer, and R. Bryant (*J. Amer. Chem. Soc.*, 1943, 65, 293–294).—The solubility of PbCl_2 in $(\text{CH}_2\text{OH})_2$ is 0.0309 mol. per 1000 g. of solvent. A solvate, $\text{PbCl}_2 \cdot 2(\text{CH}_2\text{OH})_2$, of low stability, has been isolated. W. R. A.

Hysteresis in sorption. VII. Scanning of the hysteresis loop. Alumina gel-water system. VIII. Permanence and scanning of the hysteresis loop. Titania gel-carbon tetrachloride system. IX. Effect of temperature on the hysteresis loop. Silica gel-water system. K. S. Rao (*Proc. Indian Acad. Sci.*, 1942, 16, A, 298–300, 301–304, 305–306).—VII. The general characteristics obtained on scanning the hysteresis loop for the sorption of H_2O vapour on Al_2O_3 gel conform to those of other similar systems.

VIII. The permanent hysteresis effect with CCl_4 on TiO_2 gel is similar to that of other similar systems and, like them, supports the cavity concept (cf. A., 1940, I, 68).

IX. Hysteresis loops for sorption and desorption of H_2O on SiO_2 gel at 30° , 35° , and 40° are identical. This identity is in accord with the cavity theory. W. R. A.

Anomalous mixed system potassium sulphate-Ponceau-red.—See A., 1943, I, 146.

Conductivity of thin layers of powdered sorbents in condition of sorption of gases and vapours.—See A., 1943, I, 154.

Surface area of oxide-coated cathodes by adsorption of gas at low pressure.—See A., 1943, I, 166.

Properties of optical glasses with chemically altered surfaces.—See A., 1943, I, 119.

Adsorption analysis of amino-acids and peptides. A. Tiselius (*Arkiv Kemi, Min., Geol.*, 1942, 15, B, No. 6, 5 pp.).—The adsorption of a large no. of NH_2 -acids and peptides on C has been investigated. There is considerable individual variation in the extent of the adsorption, as measured by the sp. retardation vols. The latter vary with the pH, and the dicarboxylic NH_2 -acids and monocarboxylic $(\text{NH}_2)_2$ -acids were investigated in buffer solutions in the neighbourhood of the isoelectric point. Glycine alone showed no measurable adsorption. The possibility of using the different adsorption of the various substances examined for the separation of NH_2 -acids is discussed. A. J. M.

Diffusion of gases through highly polymerised substances. II. Permeation of noble gases through various organic films and its relation to their permeability to water. F. H. Müller (*Kolloid-Z.*, 1942, 100, 355–361).—The diffusion of He, A, Kr, Xe, Ne, H_2 , O_2 , and H_2O vapour through films of polystyrene (I), polyvinyl chloride (II), and cellulose triacetate (III) has been measured. With increasing mol. wt. of the gas the diffusion coeff. decreases. The order of permeability of the films towards H_2O is (III) $>$

(I) $>$ (II), the coeff. of permeability of (I) and (II) increasing slightly with rise of temp., whilst for (III) it decreases rapidly. C. R. H.

Stable hydrogen peroxide aerosol.—See B., 1943, I, 200.

Effect of surface-active substances on formation and coagulation of aerosols. I. V. Petrianov, M. V. Tichomirov, and N. N. Tunitzki (*J. Phys. Chem. Russ.*, 1941, 15, 811).—The stability of Fe_2O_3 aerosols is unaffected by the presence of PhOH in the atm. R. T.

Concentration function in the foaming of partly foamable solutions. I. H. J. Breitner (*Kolloid-Z.*, 1942, 100, 335–349).—The characteristics of 88 foaming agents are tabulated. Apparatus for measuring the physical and mechanical properties of foams is described and is illustrated by investigations on the bubble size, thickness, and stability of foams prepared with Patent-blue and on the effect of changes in concn. C. R. H.

Elliptic polarisation of light scattered in silver sols. P. S. Hariharan (*Proc. Indian Acad. Sci.*, 1942, 16, A, 283–286).—A series of five unprotected Ag sols has been studied, particularly with reference to the presence of ellipticity in the transversely scattered light. The results agree with those obtained by Krishnan (A., 1937, I, 409) for similar sols by measuring the dispersion of polarisation. W. R. A.

Vibration-viscosimetric measurements on concentrated suspensions. H. Erbring and S. Broese (*Kolloid-Z.*, 1942, 100, 332–335).—A vibration-viscosimeter has been constructed and the measurement, at different amplitudes, of the η of conc. thixotropic suspensions of bentonite (I), blanc fixe (II), and satin-white (III) is described. The addition of (II) to (I) increases η but addition of (III) to (I) reduces η and then increases it, min. η occurring in mixtures containing 5–10% of (III). C. R. H.

Effect of aggregation (micelle formation) on viscosity. W. Philippoff (*Kolloid-Z.*, 1942, 100, 320–327).—Three types of aggregation are discussed, viz., lateral aggregation, where the aggregates (A) are less asymmetric than the primary particles (P) and η decreases with increase in the size of A, linear aggregation where A are more asymmetric than P and η increases with increase in the size of A, and cases where A and P are geometrically similar and η remains const. with increase in the size of A. Examples of each type are drawn from published data. C. R. H.

Viscosity of mixtures of linear highly polymerised substances. W. Broser and H. E. Krüger (*Kolloid-Z.*, 1942, 100, 327–331).—A mixture rule for calculating the η of solutions and melts of linear highly polymerised substances has been derived and satisfactorily applied to available data. C. R. H.

Rubber solutions and gels.—See B., 1943, II, 160.

Electron microscopy of cellulose films. W. Wergin (*Kolloid-Z.*, 1942, 100, 436–437).—Polemical, in reply to Frey-Wyssling (cf. A., 1943, I, 126). C. R. H.

Forms of cellulose and their differentiation.—See B., 1943, II, 149.

Reversibility of solutions of cellulose nitrate, benzylcellulose, and gelatin. I. Dissolution and swelling of cellulose esters. II. A. Tager and V. A. Kargin (*J. Phys. Chem. Russ.*, 1941, 15, 1029–1035, 1036–1054).—I. The solubility of benzylcellulose (I) in PhMe at 25° increases with the amount of (I) used but the dissolved part of (I) forms less viscous solutions than the undissolved residue. Qualitatively, dissolution of (I) in PhMe and C_6H_6 , and of gelatin in H_2O , appears to be reversible.

II. The heat of dissolution of cellulose nitrate (II) in COMe_2 is 16–18 g.-cal. per g., and of cellulose acetate (III) (56% of OAc) in COMe_2 9–11 g.-cal. per g., almost independent of dilution. The heat of sorption of COMe_2 and of COMeEt from gasoline by (II) is \propto the amount sorbed. The heat of dissolution of cellobiose octa-acetate (IV) in COMe_2 and in CHCl_3 is very different from that of (III); the difference is due probably to (IV) being cryst. and (III) liquid. Other properties of polymerides also indicate their liquid nature. J. J. B.

Highly dehydrated gelatin films and their electrical conductivity. L. Gombay (*Kolloid-Z.*, 1942, 100, 350–355).—Dehydration of gelatin films by heating is irreversible and by vac. treatment is reversible. In the latter case H_2O is removed in two stages. H_2O held in the capillaries is easily removed but H_2O forming part of the colloid structure is removed slowly and with difficulty. The electrical conductivity of gelatin diminishes with dehydration, the removal of capillary-held H_2O reducing the conductivity 100-fold. C. R. H.

VI.—KINETIC THEORY. THERMODYNAMICS.

Stoichiometric association of dipolar molecules in solution. H. Dunken (*Z. physikal. Chem.*, 1940, B, 45, 201–215).—The association of certain polar, solute mols. in non-polar solvents, computed from osmotic data, obeys the law of mass action. In the fatty acid series, $\text{C}_{17}\text{H}_{35}\cdot\text{CO}_2\text{H}$ and $\text{C}_{15}\text{H}_{31}\cdot\text{CO}_2\text{H}$ in C_6H_6 form nearly exclusively double mols., whereas $\text{C}_{11}\text{H}_{23}\cdot\text{CO}_2\text{H}$ forms both double and triple mols. BzOH and $1:3:5\text{-C}_6\text{H}_3\text{Me}_2\cdot\text{CO}_2\text{H}$ in C_6H_6 also

form both double and triple mols. Bu^oOH in cyclohexane forms quadruple mols. without intermediate stages. W. R. A.

Ionisation and dissociation by electron impact. Δ^a -Butene. D. P. Stevenson (*J. Amer. Chem. Soc.*, 1943, **65**, 209—212).—Appearance potentials and relative abundances of many of the ions of CH₂:CHEt (I) are reported. The vertical ionisation potential of (I) is > that of CH₂:CMe₂ by 0.8 e.v. The heat of dissociation of the Et-C₂H₃ bond is $3.3_0 \pm 0.2$ e.v. The ionisation potential of the vinyl radical is $9.8_7 \pm 0.2$ e.v. W. R. A.

Effect of temperature on the dissociation of strong electrolytes by Raman effect. N. R. Rao (*Current Sci.*, 1942, **11**, 429—430).—The Raman lines associated with ions and with undissociated mols. from H₂SO₄, HNO₃, and HIO₃ show variation in relative intensities with increase in temp. Lines characteristic of ions decrease in intensity compared with those representing undissociated mols. as the temp. is increased. Influences of concn. on intensity changes are discussed. W. R. A.

Ionisation constants of *aci*- and nitro-forms of nitroparaffins. D. Turnbull and S. H. Maron (*J. Amer. Chem. Soc.*, 1943, **65**, 212—218).—Ionisation consts. for the nitro-form of MeNO₂ and for the nitro- and *aci*-forms of EtNO₂ and PrⁿNO₂ have been determined at various temp., and the nitro-*aci* tautomeric equilibrium consts. for the three compounds have been calc. Vals. of ΔG° and ΔH for ionisation and tautomerisation have been derived. Instead of the usual assumption that both forms yield a common anion, the existence of two tautomeric ions in equilibrium, RR'C⁺-NO₂ and RR'C:NO₂⁺, is postulated. W. R. A.

Steric strains and the anomalous base strengths of the methylamines. H. C. Brown and H. Bartholomay, jun. (*J. Chem. Physics*, 1943, **11**, 43).—The dissociation consts. (K_p) of additive compounds of BMe₃ with NH₃, NH₂Me, NHMe₂, and NMe₃ in the vapour phase at 89.5—89.7° are respectively 2.7, 0.0176, 0.00991, 0.197, in the same order as the dissociation consts. (K_b) of the bases in H₂O solution. The order found is attributed to opposing effects of inductive effect of the Me group and steric strains between N-C linkages. L. J. J.

Acidic ionisation constant of glycine in dioxan-water solutions. H. S. Harned and C. M. Birdsall (*J. Amer. Chem. Soc.*, 1943, **65**, 54—57).—The acidic ionisation const. of glycine has been calc. from e.m.f. measurements carried out in media containing 0, 20, 45, and 70 wt.-% of dioxan from 0° to 50°. Thermodynamic quantities at 25° have been evaluated. W. R. A.

Thermodynamics of aqueous solutions of sodium chloride at temperatures from 15° to 45° from e.m.f. measurements on cells with transference. G. J. Janz and A. R. Gordon (*J. Amer. Chem. Soc.*, 1943, **65**, 218—221).—The e.m.f. of the cell with transference Ag, AgCl|NaCl (m_1)||NaCl (m_2)|AgCl, Ag has been measured at 15—45° up to 0.1M. and activity and osmotic coeffs. have been computed in good agreement with existing data. The temp. variation of the activity coeff. is in good accord with heat of dilution and C_p data. W. R. A.

Vapour pressure of aqueous sodium chloride at 20°, 25°, and 30° from 2 molal to saturation. P. Olynyk and A. R. Gordon (*J. Amer. Chem. Soc.*, 1943, **65**, 224—226).—The v.p. of aq. NaCl (2M. to saturation) at 20°, 25°, and 30°, measured by a static method, agree well with many, but not all, recorded data. The calc. activities of H₂O and activity coeffs. of NaCl are tabulated. W. R. A.

Cerium amalgam electrode and the thermodynamics of aqueous cerous sulphate. G. C. Walters and T. de Vries (*J. Amer. Chem. Soc.*, 1943, **65**, 119—122).—The standard molal potential of a two-phase Ce amalgam as an electrode with Ce₂(SO₄)₃ solutions has been calc. for 15°, 25°, and 35°, and it is shown that such an amalgam is obtained at >0.312 wt.-% Ce. The mean activity coeffs. of Ce₂(SO₄)₃ from 0.007M. to saturation and ΔH , ΔG , and S_{25} for the cell reaction have been calc. W. R. A.

Dissociation pressures of compounds of ammonia and trideuterammonia with some metallic salts. A. B. Hart and J. R. Partington (*J.C.S.*, 1943, 104—118).—V.p. of NH₃ and ND₃ in the range -60° to -30° and dissociation pressures of the amines and deuteramines of CaCl₂, CaBr₂, BaBr₂, FeCl₂, NiCl₂, MnCl₂, LiCl, LiBr, LiI, NaI, and CuSO₄ have been measured and heats of decomp. calc. From d measurement the mol. vol. of NiCl₂.6ND₃ is 0.08% < that of NiCl₂.6NH₃. F. R. G.

Hydrothermal study of equilibria in the system alumina-water. A. W. Laubengayer and R. S. Weisz (*J. Amer. Chem. Soc.*, 1943, **65**, 247—250).—The system Al₂O₃-H₂O has been investigated by the hydrothermal method from 100° to 500° and the phases involved have been identified by X-ray and microscopical method. Above 450 \pm 5° corundum is the stable phase, from ~280° to 450°, diasporite; other phases are böhmite (155—280°), gibbsite (<155°), bayerite (<155° but less stable than gibbsite), and γ -alumina (metastable from 100—500°). Diasporite has been synthesised. W. R. A.

Molecular compound of optically active di-(α -carboxyethyl) disulphide and $\alpha\alpha'$ -dithioladipic acid. A. Fredga (*Arkiv Kemi, Min.,*

Geol., 1941, **14**, B, No. 15, 5 pp.).—M.p. diagrams of mixtures of (-)-di-(α -carboxyethyl) disulphide and (-)- $\alpha\alpha'$ -dithioladipic acid indicate that a 1:1 mol. compound is formed. A. T. P.

Configurative relationship between optically active lactic and α -thiolpropionic acids. A. Fredga (*Arkiv Kemi, Min., Geol.*, 1940, **14**, B, No. 12, 8 pp.).—(+)-O(CHMe·CO₂H)₂ (I) and (+)-S(CHMe·CO₂H)₂ (II) give normal f.p. curves with (+)-CH₂(CHMe·CO₂H)₂ (III), but (-)-(I) and (-)-(II) give with (+)-(III) racemic type 1:1 compounds, m.p. 91° and 109° respectively [continuous ranges of solid solutions with r -(III)], and 1:3 compounds, m.p. 97° and incongruent m.p. 81° respectively. It is concluded that (+)-(I), (+)-(II), and (+)-(III), and thus (A., 1908, i, 714; 1935, 474) (-)-OH·CHMe·CO₂H and (+)-SH·CHMe·CO₂H, are of similar configuration (but cf. A., 1927, 1171). M. H. M. A.

Configurative relationship between optically active malic and thiomalic acid. A. Fredga (*Arkiv Kemi, Min., Geol.*, 1941, **14**, B, No. 27, 8 pp.).—M.p. curves are recorded for mixtures of (+)- and (-)-OEt·CS·S·CH(CO₂H)·CH₂·CO₂H (I), (+)- and (-)-SEt·CS·O·CH(CO₂H)·CH₂·CO₂H (II), (+)-(II) and (-)- or (+)-(I), r -(I) and r -(II), etc. (+)-(I) and (+)-(II) form a 1:1 mol. compound which may be regarded as an "active racemate," whence it is inferred that these acids possess opposite configurations (cf. preceding abstract). Results are discussed and some vals. of $[\alpha]_D$ are recorded. A. T. P.

System water-*n*-butyl alcohol-toluene at 30°. R. M. Fuoss (*J. Amer. Chem. Soc.*, 1943, **65**, 78—81).—Equilibrium concns. at 30° for the two-phase system, H₂O-Bu^oOH-PhMe have been determined, and a new method of determining liquid solubilities is described. Vals. of ρ and n are given. W. R. A.

Solution equilibria in aqueous systems. I. System K-NH₄-Na-Cl-NO₃-H₂O at 20°. H. Schütze, T. Piechowicz, and B. Wahl. **II. System K-NH₄-Na-Cl-HCO₃-H₂O at 20°.** H. Schütze, T. Piechowicz, and W. Pustelnik. **III. System NH₂·CO₂NH₄-(NH₄)₂SO₄-NH₃-H₂O.** H. Schütze and T. Piechowicz (*Helv. Chim. Acta*, 1943, **26**, 233—237, 237—241, 242—245).—I. Phase diagrams of the aq. systems NaCl-NH₄Cl-NH₄NO₃-NaNO₃, NH₄Cl-KCl-NaCl, KNO₃-NaNO₃-NH₄NO₃, and the combined system K⁺-NH₄⁺-Na⁺-Cl⁻-NO₃⁻-H₂O have been constructed and the compositions of the five univariant solutions tabulated.

II. Phase diagrams of the aq. systems NH₄HCO₃-NaHCO₃-KHCO₃, KHCO₃-NH₄CO₃-NH₄Cl-KCl, KHCO₃-NaHCO₃-NaCl-KCl, and the combined system K⁺-NH₄⁺-Na⁺-Cl⁻-HCO₃⁻-H₂O have been constructed and the compositions of the nine univariant solutions tabulated.

III. The solubility relations of the system (NH₄)₂SO₄-NH₃-H₂O over the range 20—108.5° and those of the system NH₂·CO₂NH₄-(NH₄)₂SO₄-NH₃-H₂O over the range 20—50° are expressed in diagrammatic form. C. R. H.

Thermodynamics of hydration of electrolytes. A. F. Kapustinski (*J. Phys. Chem. Russ.*, 1941, **15**, 1055—1056).—The equation for the entropy of hydration $\Delta S = B - An/r$, where n = valency, r = radius (cf. Coulter, Pitzer, and Latimer, A., 1941, I, 47) is a consequence of Kapustinski's theory (*ibid.*, 417). J. J. B.

VII.—ELECTROCHEMISTRY.

Conductometric behaviour of lithium chloride solutions. M. Jacopetti (*Gazzetta*, 1942, **72**, 251—262; cf. A., 1940, I, 257).—Data for η and A of 0.5—7M-LiCl at 18—100° are tabulated. The fraction of free ions in the solutions is calc. and it is shown that the data are in agreement with Ghosh's theory. F. O. H.

Conductance of aqueous solutions of potassium bromide at temperatures from 15° to 45° and the limiting mobility of the bromide ion. H. E. Gunning and A. R. Gordon (*J. Chem. Physics*, 1943, **11**, 18—20).—Vals. of A for aq. KBr at 0.0005—0.01N. and 15—45° have been measured by the authors' d.c. method (A., 1942, I, 206). The Shedlovsky function A_0' is linear with concn. at 25—45°; at 15° a small logarithmic term is involved. The limiting mobility of Br⁻, calc. from the known K⁺ val., is 63.17, 78.15, 94.07, and 110.65 at 15°, 25°, 35°, and 45°, respectively; its temp. coeff. is uniformly ~2% < vals. for Cl⁻. L. J. J.

Electrical conductivity of triethylsulphonylmethane. E. Samén (*Arkiv Kemi, Min., Geol.*, 1941, **14**, B, No. 28, 5 pp.).—The conductivities of 0.0004—0.005M. aq. CH(SO₂Et)₃ (I) have been measured at 25°. At these concns. (I) behaves as though completely ionised, its equiv. conductivity following the equation $\Lambda_e = 372.89 - 144.59\sqrt{c}$. J. W. S.

Conductivity of thin layers of powdered sorbents in conditions of sorption of gases and vapours. N. A. Figurovski and A. M. Smirnova (*J. Phys. Chem. Russ.*, 1941, **15**, 760—767).—The conductivity of thin layers of powdered C rises on exposure to CCl₄, Et₂O, C₆H₆, or C₅H₁₁·OH vapours. This is ascribed to swelling of the grains following adsorption of vapour, with resultant closer contact between them. R. T.

Oxidation potential of cerous-ceric perchlorates. M. S. Sherrill, C. B. King, and R. C. Spooner (*J. Amer. Chem. Soc.*, 1943, **65**, 170—179).—From e.m.f. measurements on cells in which the reaction $\frac{1}{2}\text{H}_2(\text{g}) + \text{Ce}(\text{ClO}_4)_4 \rightleftharpoons \text{Ce}(\text{ClO}_4)_3 + \text{HClO}_4$ occurred, the formal oxidation potential of $\text{Ce}^{\text{III}}\text{--Ce}^{\text{IV}}$ perchlorates in HClO_4 (0.2—2.4 wt.-formal) is found to vary with $[\text{H}^+]$ but to be independent of $[\text{ClO}_4^-]$. Apparently neither $\text{Ce}(\text{ClO}_4)_3$ nor $\text{Ce}(\text{ClO}_4)_4$ reacts with HClO_4 . $\text{Ce}(\text{ClO}_4)_3$ is not hydrolysed in presence of HClO_4 , but $\text{Ce}(\text{ClO}_4)_4$ is hydrolysed and yields CeOH^{+++} and $\text{Ce}(\text{OH})_2^{++}$ ions so as to satisfy the equilibrium $\text{CeOH}^{+++} + \text{H}_2\text{O} \rightleftharpoons \text{Ce}(\text{OH})_2^{++} + \text{H}^+$ ($K = 0.6$). The mol. oxidation potentials of the electrode reactions $\text{CeOH}^{+++} + \text{H}^+ + e = \text{Ce}^{++} + \text{H}_2\text{O}$ and $\text{Ce}(\text{OH})_2^{++} + 2\text{H}^+ + e = \text{Ce}^{++} + 2\text{H}_2\text{O}$ are 1.7134 and 1.7265 v. W. R. A.

Polarisation in ionic oxidation-reduction processes. I. L. Antropov. II. L. Antropov and E. Mizgerova (*J. Phys. Chem. Russ.*, 1941, **15**, 768—775, 776—792).—I. Theoretical. Expressions connecting ionic over-potential with polarisation potential in electrolytic redox processes of the type $\text{Fe}^{\text{II}} \rightleftharpoons \text{Fe}^{\text{III}}$ are derived, and the retardation of desorption and discharge of ions are discussed in relation to such processes.

II. Experimental results are in conformity with the above expressions in the cases $\text{Fe}^{\text{III}} \rightleftharpoons \text{Fe}^{\text{II}}$, $\text{Ti}^{\text{III}} \rightleftharpoons \text{Ti}^{\text{IV}}$, $\text{Ce}^{\text{IV}} \rightleftharpoons \text{Ce}^{\text{III}}$, and $\text{V}^{\text{V}} \rightleftharpoons \text{V}^{\text{IV}}$. R. T.

Polarographic studies. II. Mould metabolites and related quinones. J. E. Page and F. A. Robinson (*J.C.S.*, 1943, 133—135; cf. A., 1942, I, 279).—Polarographic behaviour of citrinin, penicillic acid (I), fumigatin, spinulosin, *p*-tolu-, ψ -cumo-, duro-, 6-bromo-2:3:5-trimethylbenzo-, 4-methoxytolu-, 4:6-dimethoxy-2:5-tolu- (II), and 2-methyl-1:4-naphtha-quinone, and 2:5-dihydroxy-4:6-dimethoxytoluene, m.p. 148°, obtained by reduction of (II), shows an absence of correlation between oxidation-reduction potential and anti-bacterial activities. The dissociation const. of (I) is 1.26×10^{-8} at 25°. F. R. G.

Polarographic investigations of hydrogen bonding. I. *o*- and *p*-nitrophenols. M. J. Astle and W. V. McConnell (*J. Amer. Chem. Soc.*, 1943, **65**, 35—38).—The presence of H-bonds in *o*- $\text{NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ (I) in buffered H_2O solutions has been detected polarographically; the half-wave reduction potentials are more positive than those for *p*- $\text{NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ (II) or *o*- $\text{NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{OMe}$ in acid solution but all have approx. the same vals. in basic solution. The wave height for the reduction of (I) in acid solution is $\sim \frac{2}{3}$ the height for (I) in basic solution or for (II) at any pH. Thus the hydroxylamine formed by the reduction of (I) is stabilised by a H-bond preventing further reduction to the amine. In solutions of pH 6.0 to 9.5 (I) appears to consist of a mixture of chelated and unchelated mols., but at pH > 9.5 (I) shows no indication of H-bonds. W. R. A.

Constitution of Roussin's salts. W. D. Treadwell and D. Huber (*Helv. Chim. Acta*, 1943, **26**, 18—29).—A series of Roussin's salts were prepared and electrometrically titrated with $\text{K}_3\text{Fe}(\text{CN})_6$ in alkaline solution. Complex formation with NO replacing CN moves the oxidation-reduction potential to more positive vals., the normal metal^I/metal^{II} potentials being 400—600 mv. more positive than those of the corresponding CN complexes. The formation of Roussin's salts depends on a coupled reaction involving the formation of Fe^{I} , Co^{I} , or Ni^{I} with a corresponding oxidation of the anionic sulphide group. C. R. H.

Mechanism of action of colloids (dextrin) on the electro-deposition of zinc and cadmium. P. F. Michalev (*J. Phys. Chem. Russ.*, 1941, **15**, 793—796).—Electrodeposition of Zn and Cd from aq. sulphates takes place at a more negative potential in presence of dextrin (I), and the structure of the deposit becomes more finely granular. Polarisation is also greater in presence of (I), to an extent diminishing with rising temp. The (I) content of the deposit varies inversely with temp. R. T.

VIII.—REACTIONS.

Theory of complex reactions. I. Basis of the theory. Kinetic simplexes. II. Kinetic complexes. Property diagrams. Super-reactions. A. A. Balandin (*J. Phys. Chem. Russ.*, 1941, **15**, 615—628, 629—644).—I. Chemical reactions consisting of > one step can be expressed graphically in forms similar to the usual and the stereochemical formulæ of mols. The law of active masses is applicable to complex reactions if, instead of concns., "matrices" (functions of the single steps of the reactions) are used.

II. "Stereochemical formulæ" are given for several complex reactions. They can be used for determining the change of properties of a reacting mixture in the course of the reactions. J. J. B.

Thermal decomposition and oxidation of sulphur monoxide. E. Kondrateeva and V. Kondrateev (*J. Phys. Chem. Russ.*, 1941, **15**, 731—738).—The decomp. of S_2O_2 at 54—144° is a chain reaction, one or more stages of which take place at the walls of the vessel. The velocity rises exponentially with rising temp., and is independent of $[\text{S}_2\text{O}_2]$. The activation energy is 3.0 kg.-cal. In presence of O_2 the process is represented thus: $2\text{S}_2\text{O}_2 \rightarrow 2\text{SO}_2 + \text{S}_2$; $\text{S}_2 + \text{O}_2 \rightarrow 2\text{SO}$; $\text{SO} + \text{S}_2\text{O}_2 \rightarrow \text{SO}_3 + \text{S}_2$; $\text{SO} + \text{SO}_3 \rightarrow 2\text{SO}_2$. R. T.

Spontaneous ignition of $2\text{H}_2 + \text{O}_2$ mixtures in silver vessels. A. B. Nalbandjan (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 196—198).—In examining the spontaneous ignition of $2\text{H}_2 + \text{O}_2$ mixtures in Ag vessels, the rapidity of the surface reaction makes very rapid filling necessary, since ignition is inhibited by H_2O . The lower limit of spontaneous ignition in the Ag vessel used decreased with increasing temp. from 32 mm. at 578° to 17 mm. at 655°. The ignition has an induction period which decreases rapidly with increasing pressure above the ignition limit, and at the limit decreases with increasing temp. The shortness of the induction period and the surface reaction prevent the upper limit from being determined. L. J. J.

Influence of water vapour on the combustion of hydrocarbon mixtures. W. T. David and J. Mann (*Nature*, 1943, **151**, 392).—Dil. C_2H_4 -air and C_4H_{10} -air mixtures gave flame temp. respectively 70° and 25° > dry mixtures but as the hydrocarbon concn. increased the differences diminished. At 90% of the theoretical proportion the "moist" and "dry" temp. were sensibly the same. For 21% $\text{H}_2\text{--O}_2$ the difference was 50°, whilst for 26% $\text{H}_2\text{--O}_2$ it was only 20°. A. A. E.

Kinetic study of the heterogeneous interaction between dry sulphur dioxide and nitrogen dioxide below 150°. V. V. Illarionov (*J. Phys. Chem. Russ.*, 1941, **15**, 1113—1120; cf. A., 1943, I, 149).—The rate of reaction between SO_2 and NO_2 was measured in glass vessels at 20—131°. The main reaction takes place at the walls of the vessel covered with the reaction product $(\text{SO}_3)_2\text{N}_2\text{O}_3$; hence there is often an induction period. At higher pressure this reaction is of zero order. J. J. B.

Condensation of supersaturated vapours. N. Tunitzki (*J. Phys. Chem. Russ.*, 1941, **15**, 1061—1071).—The rate of condensation of H_2O vapour at adiabatic expansion is calc. The results agree with the experimental data by Wilson (cf. A., 1898, ii, 372) but disagree with those by Barus (*Ann. Physik*, 1907, **24**, 225) and Andrén (A., 1917, ii, 192). J. J. B.

Kinetics and energetics of the high-temperature cracking of methane to acetylene. N. I. Kobozev and L. I. Kastanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **33**, 28—33).—Equations are given for the kinetics of the various dehydrogenation reactions occurring in the cracking of CH_4 to C_2H_2 at high temp. The equilibrium consts. are obtained. The high-temp. reactions, in contrast to those occurring at lower temp., do not take place at the walls. A. J. M.

Peculiarities of chain reactions and common energy levels in living systems.—See A., 1943, III, 271.

Kinetics of bimolecular reactions in non-aqueous solutions. V. A. Goltzschmidt and N. K. Vorobiev (*J. Phys. Chem. Russ.*, 1941, **15**, 1087—1093).—The rate of the reactions $\text{C}_5\text{H}_5\text{N} + \text{C}_3\text{H}_5\text{Br} \rightarrow \text{C}_5\text{H}_5\text{N}(\text{C}_3\text{H}_5)\text{Br}$ (irreversible) and $\text{NMe}_2\text{Ph} + \text{C}_3\text{H}_5\text{Br} \rightleftharpoons \text{C}_3\text{H}_5\cdot\text{NMe}_2\text{PhBr}$ (reversible) is measured in PhNO_2 , CHCl_3 , COMe_2 , and MeOH at 18—38°; in MeOH also the reaction $\text{C}_3\text{H}_5\text{Br} + \text{MeOH} \rightarrow \text{C}_3\text{H}_5\cdot\text{OMe} + \text{HBr}$ (A) takes place. The velocity coeffs. are independent of the original concn. (0.04—0.2M.); in MeOH the reaction (A) has to be subtracted. This agreement with the law of mass action is due to the similarity between solvent and solute in the experiments described. J. J. B.

Kinetics of the transformation of hydrazine cyanate into semicarbazide. E. M. Baker and E. C. Gilbert (*J. Amer. Chem. Soc.*, 1942, **64**, 2777—2780).—The formation of semicarbazide (I) from hydrazine cyanate takes place readily at room temp. Increase in ionic strength reduces the velocity of reaction in agreement with the assumption that the rate-determining process is the reaction between the hydrazine and cyanate ions. The reaction reaches equilibrium far to the side of formation of (I). Quant. results are given for the velocity coeffs. of the reaction at 15° and 25°, the equilibrium const., salt effects, temp. coeff., and heat of activation. W. R. A.

Organic silicic acid compounds. III. Saponification and polymerisation of silicic esters in organic media. L. Holzapfel (*Kolloid-Z.*, 1942, **100**, 380—388).—The saponification and polymerisation of Me and Et silicates in presence of alcohols, glycerol, and phenolic compounds has been investigated. The rate of polymerisation increases with the no. of OH groups in the added compound and, in the case of phenolic compounds, in the order $p > m > o$. The rate of polymerisation in presence of phenolic compounds \propto concn. of the latter, but with increase in concn. of aliphatic compounds the rate rises to a max. and then decreases. The data, in conjunction with similar data by other investigators, and the results of examination by means of X-rays and the electron microscope are discussed with reference to the reaction mechanism and to the structure of the polymerisation products. C. R. H.

Kinetics of the reaction between γ -ethylsulphonylbutan- β -one and bromine in aqueous hydrobromic acid. L. Ramberg and B. Backlund (*Arkiv Kemi, Min., Geol.*, 1941, **15**, A, No. 4, 11 pp.).—The reaction: $\text{EtSO}_2\cdot\text{CHMe}\cdot\text{COME}$ (I) + $\text{Br}_2 \rightarrow \text{EtSO}_2\cdot\text{CBrMe}\cdot\text{COME}$ (II) + HBr , has been studied in 0.1—1.0N-HBr

at 25°, with [I] concn. $>[\text{Br}_2] = 0.025\text{--}0.05$. The reaction is substantially unimol. and $k = 0.011$. Deviations from unimolecularity occur at the beginning, due to the presence of an active form of (I), and at the end of the reaction, due to further bromination. k is slightly decreased by excess of Br, and by increase in (equimol.) concn. of the reactants. Since (II) oxidises KI, free Br was determined by addition of excess of AsO_3^{3-} , followed by electrometric back-titration against BrO_3^- . M. H. M. A.

Velocity of hydrolysis of sulphonyl chlorides. I. Hedlund (*Arkiv Kemi, Min., Geol.*, 1940, 14, A, No. 6, 17 pp.).—The rate of hydrolysis of $\text{R-SO}_2\text{Cl}$ ($\text{R} = \text{Me}$, Et, Cl-CH_2 , Ph, $p\text{-C}_6\text{H}_4\text{Me}$, o -, m -, and $p\text{-NO}_2\text{-C}_6\text{H}_4$) was studied at 15–25° by conductivity measurements. The results in H_2O were completely in agreement with electronic theory, but showed great irregularities in 42% COMe_2 . A (not thermally insulated) thermostat const. to $\pm 0.001^\circ$ when the room temp. is const. to $\pm 1.5^\circ$ is described. M. H. M. A.

Kinetics of the aqueous hydrolysis of sodium phenylbromoacetate and sodium phenylchloroacetate. W. R. Bulcraig and H. M. Dawson (*J.C.S.*, 1943, 80–84).—Aq. hydrolysis of CHPhBr-CO_2^- is unimol. in presence of excess of alkali and hence is probably a unimol. ionisation giving $\text{C}^+\text{HPh-CO}_2^-$ as intermediate. In neutral solution equilibrium is set up and the deviation from the unimol. reaction is calc. From data at 0° and 25° the energy of activation (E) is 29,130 g.-cal. Similar results were obtained with CHPhCl-CO_2^- , which has E 29,680 g.-cal. F. R. G.

Rate of conversion of ammonium cyanate into carbamide in non-aqueous solvents. VI. W. J. Svrbely and S. Peterson (*J. Amer. Chem. Soc.*, 1943, 65, 166–170).—The rate of conversion of NH_4CNO into $\text{CO(NH}_2)_2$ has been investigated in MeOH, EtOH, Pr^nOH , $(\text{CH}_3)_2\text{OH}$, and glycerol over a 30° range. Sp. solvent effects are more important than salting-out effects in accounting for deviations from the linearity between rate coeff. and $1/D$ predicted by Scatchard. Vals. of the Arrhenius factor B and of the energy of activation in each solvent have been computed. (Cf. A., 1940, 1, 121.) W. R. A.

Kinetics of the ammonolysis of 9-chloro-9-phenylfluorene by liquid ammonia. P. M. Williamson, R. C. Anderson, and G. W. Watt (*J. Amer. Chem. Soc.*, 1943, 65, 49–51).—The ammonolysis of 9-chloro-9-phenylfluorene by liquid NH_3 is a pseudo-first-order reaction autocatalysed by NH_4Cl . Vals. of velocity coeffs. and energies of activation for catalysed and uncatalysed reactions have been determined. W. R. A.

Velocity of oximation of cyclohexanones.—See A., 1943, II, 164.

Action of halogen acids on alcohols in presence of benzene.—See A., 1943, II, 149.

Exchange of radioactive silver and bromide with silver bromide suspensions. A. Langer (*J. Chem. Physics*, 1943, 11, 11–15).—Radioactive Ag^+ and Br^- (half-life 34 hr., produced by H^+ bombardment of Se) in aq. solution both exchange with Ag^+ and Br^- in AgBr suspensions, the exchange of Ag^+ being the faster. The exchange rate decreases with ageing of the ppt. and corresponds with the surface area as indicated by dye adsorption. Equilibrium corresponds with a homogeneous distribution of radioactivity. Previous adsorption of methylene-blue or eosin markedly slows down Br^- exchange, whilst Ag^+ exchange is unaffected. L. J. J.

Burning of mercury fulminate at low pressures. A. F. Beliaev and A. E. Beliaeva (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 41–44).—The burning of Hg fulminate at pressures from 760 mm. down to 2–3 mm. has been investigated. The brightness of the flame decreases considerably as the pressure is reduced, and at 8 mm. it is scarcely visible. The velocity of combustion, however, is practically unaltered by pressure. At 20 mm. the vol. of gas produced in the combustion is only 15–20% of that expected if combustion had been complete, and there is a considerable deposit of Hg fulminate contaminated with Hg. An explanation of the phenomena is advanced. A. J. M.

Rate of dissolution of magnesium in acids. T. H. James (*J. Amer. Chem. Soc.*, 1943, 65, 39–41).—The rate of dissolution of Mg in various acids (HCO_2H , AcOH , valeric, glycolic, HSO_4^- , and HCl) has been investigated by a method independent of the agitation rate and the rates appear to be those of the chemical reaction. The rate of reaction with undissociated acids is $<$ that with H_3O^+ and NaCl has practically no effect on the rates of the undissociated acids although it accelerates the H_3O^+ rate. The apparent energy of activation of AcOH is 5100 and of H_3O^+ 4900 g.-cal. W. R. A.

Hydration of the aluminates of calcium. III. Hydration of the 5:3, 1:1, and 3:5 calcium aluminates. W. G. Schneider and T. Thorvaldson (*Canad. J. Res.*, 1943, 21, B, 34–42).—The rate of hydration at 150° of $5\text{CaO} \cdot 3\text{Al}_2\text{O}_3$ (I) is \ll the rates for $3\text{CaO} \cdot \text{Al}_2\text{O}_3$ (II), $\text{CaO} \cdot \text{Al}_2\text{O}_3$ (III), or $3\text{CaO} \cdot 5\text{Al}_2\text{O}_3$ (IV), the order being (I) \ll (IV) $<$ (III) $<$ (II). At 105° the order is (I) \ll (III) $<$ (II) $<$ (IV). Samples of Al_2O_3 , after autoclaving at 150°, have an average composition $\text{Al}_2\text{O}_3 \cdot 1.1\text{H}_2\text{O}$ with $n = 1.62\text{--}1.63$. If autoclaved at 105°

the product is of more variable composition, viz., $\text{Al}_2\text{O}_3 \cdot 1.3\text{--}2.3\text{H}_2\text{O}$. The almost complete insolubility of $\text{Al}_2\text{O}_3 \cdot 1.1\text{H}_2\text{O}$ in boiling dil. HCl offers a quant. method for separating free and combined Al_2O_3 in autoclaved mixtures of Al_2O_3 and (II) on the basis of their difference in solubility in 5% HCl . When autoclaved at 150° (III) and (IV) hydrate to (II), $6\text{H}_2\text{O}$ and $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$, whereas (I) hydrates additionally to a low-limed hydroaluminate. When autoclaved at 105° a considerable amount of anisotropic material of $n = 1.58$ is present in each case. C. R. H.

Oxidation of aldehydes catalysed by ozone; effect of solvent, surface reactions, and the presence of antioxidants. E. Briner and P. Wenger (*Helv. Chim. Acta*, 1943, 26, 30–38).—The catalytic effect of O_3 on the oxidation by O_2 of EtCHO , Pr^nCHO , and Pr^iCHO is more pronounced in CCl_4 than in aq. solution, the effectiveness per mol. of O_3 increasing with decreasing concn. of O_2 in O_3 . For a given $[\text{O}_3]$ the effectiveness increases in the order $\text{EtCHO} < \text{Pr}^i\text{CHO} < \text{Pr}^n\text{CHO}$. Quinol inhibits but does not prevent the catalytic activity of O_3 . Increase of surface in contact with the reactants has a negligible effect on the reaction. C. R. H.

Catalytic action of quaternary ammonium salts. I. V. Potapov and V. A. Goltzschmidt (*J. Phys. Chem. Russ.*, 1941, 15, 1094–1103).—The additive reactions between NPhMe_2 (I) and $\text{C}_3\text{H}_5\text{Br}$ (II) and between $\text{C}_3\text{H}_5\text{N}$ and (II) in MeOH and EtOH are accelerated by $\text{C}_3\text{H}_5\text{-NPhMe}_2\text{Br}$ (III) and $\text{C}_3\text{H}_5\text{-C}_3\text{H}_5\text{NBr}$. When the original concns. of (I), (II), and (III) are equal, the velocity coeff. is increased by (III) by a factor of 1.5–2.5. The temp. coeff. of these reactions is not affected by the catalysts. J. J. B.

Mutarotation of glucose under pressure. V. K. Bobolev and O. I. Leipunski (*J. Phys. Chem. Russ.*, 1941, 15, 1104–1107).—The velocity coeff. of mutarotation of α -glucose at 25° increases with pressure, p , 15-fold when p rises from 1 to 10,000 atm. The energy of activation is slightly reduced by pressure. J. J. B.

Kinetics of the reaction between ascorbic acid and oxygen in the presence of copper ions. (Miss) E. Silverblatt, A. L. Robinson, and C. G. King (*J. Amer. Chem. Soc.*, 1943, 65, 137–141).—The study of the kinetics of the oxidation of ascorbic acid (I) catalysed by Cu^{2+} ions at 25° has shown that when $k \leq 0.12 \text{ min}^{-1}$ the reaction rate $\propto [\text{Cu}^{2+}]$ and $[(\text{I})]$ but vals. of k depend in a complex manner on the initial concn. of (I), H^+ , and O_2 . Appreciable amounts of H_2O_2 accumulated during the reaction but a drift of the rate const. towards higher vals. occurred only with $k \leq 0.12 \text{ min}^{-1}$. Variation in k is explained by a mechanism similar to that proposed by Dekker *et al.* (A., 1940, I, 416), but the drift reported by these authors as due to the effect of H_2O_2 on the oxidation of (I) was not observed in several experiments. W. R. A.

Influence of age and surface conditions on the reactivity of certain precipitates. T. H. James (*J. Physical Chem.*, 1942, 46, 1068–1076).—The reaction of AgCl and AgCNS with NH_4OH to form N_2O is accelerated by ageing the ppts. The reaction is inhibited by traces of Br^- . Blue Cu(OH)_2 reacts rapidly at pH 10.2, much more so than the CuO which is formed on ageing. With Cu(OH)_2 the yield is almost wholly N_2O , but as the proportion of CuO increases N_2 is also formed. C. R. H.

Theory of preparation of catalysts. Rôle of free energy. S. Z. Roginski (*J. Phys. Chem. Russ.*, 1941, 15, 708–730).—Theoretical. R. T.

Kinetics of the catalytic dimerisation of ethylene. S. J. Pscheshetzki and A. T. Gladishev (*J. Phys. Chem. Russ.*, 1941, 15, 333–345).—The rate of polymerisation of C_2H_4 at a Ni catalyst at 240–360° at atm. pressure \propto the pressure of C_2H_4 . The apparent energy of activation is 10,500 g.-cal. The reaction yields a mixture of butenes and hexenes. The results indicate that the surface of the catalyst is not uniform. J. J. B.

Effect of gel water on catalytic activity. III. Decomposition of formic acid over alumina. L. A. Munro, D. J. Dewar, S. Gertsman, and G. Monteith (*Canad. J. Res.*, 1943, 21, B, 21–33).—The curve relating the amount of H_2O remaining after the activation of Al_2O_3 gel to its activity as a catalyst for the decomp. of HCO_2H to CO shows two activity max. at $\sim 3\%$ and 5–6% of H_2O . The ratio CO/CO_2 formed shows max. at approx. the same H_2O content and, in addition, a fairly high val. at zero H_2O content, although such catalysts have low activity. The gel of max. activity exhibits greatest sorption. The min. and max. of the curves cannot be explained on the basis of lattice structure; they are determined by factors connected with residual H_2O , e.g., extent, potential, and geometry of the free surface spaces liberated during activation. C. R. H.

Catalytic hydropolymerisation of acetylene under atmospheric pressure.—See B., 1943, I, 190.

Catalytic dehydrogenation of n -butane.—See B., 1943, II, 101.

Theory of metal corrosion in solutions. I, II. A. I. Schultin (*J. Phys. Chem. Russ.*, 1941, 15, 359–369, 370–381).—Dissolution and corrosion of metals are possible in the absence of micro-cells. Anodic polarisation of Zn can reduce the evolution of H_2 by Zn in

acid also when the metal is homogeneous. The rate of corrosion is related to the kinetics of electrode processes rather than to Ohm's law. J. J. B.

Cyanide complexes of univalent iron metals. W. D. Treadwell and (Frl.) D. Huber (*Helv. Chim. Acta*, 1943, **26**, 10—17).—0.1M-Cyanide complexes containing Fe^{II} , Co^{II} , and Ni^{II} were electrolysed in presence of KCN at c.d. 0.078 amp. per sq. cm. and at 12°, 12°, and 15° respectively. The resulting univalent complexes were electrometrically titrated with 0.1M- $\text{K}_3\text{Fe}(\text{CN})_6$, the results indicating a 95—97% yield of univalent complex. C. R. H.

Electrolytic oxidation. XIII. Electrolytic oxidation of formaldehyde. A. Hickling and F. Rodwell (*J.C.S.*, 1943, 90—99; cf. A., 1940, I, 226).—Electrolytic oxidation of CH_2O gives HCO_2H , CO_2 , and H_2O . In alkaline solution H_2 is also formed. Anodes of Pt and Au which are poor catalysts for decomp. of H_2O_2 give a high yield of HCO_2H . Platinised Pt and PbO_2 anodes give little HCO_2H . A scheme is presented to explain these results on the basis of oxidation by H_2O_2 and also nascent O and oxides at the anode. F. R. G.

[Electrolytic] brightening of copper.—See B., 1943, I, 211.

Electrodeposition of copper: use of thiosulphate solutions.—See B., 1943, I, 211.

Electrodeposition of silver on magnesium.—See B., 1943, I, 213.

Production, concentration, and decomposition of ozone by ultra-violet lamps. A. W. Ewell (*J. Appl. Physics*, 1942, **13**, 759—767).—A low-pressure Hg arc of the Westinghouse Sterilamp type gives ~0.01 g. of O_3 per hr., corresponding to ≤ 0.01 w. The O_3 is all produced within a few ft. radius. The equilibrium O_3 concn. in a space of several cu. m. \propto the rate of O_3 production, inversely \propto the vol., and decreases with rise in air temp. and humidity. 2537 Å. radiation inhibits O_3 formation. L. J. J.

Photoreduction of uranyl nitrate by tartaric acid. T. L. R. Char (*J. Indian Chem. Soc.*, 1942, **19**, 369—376).—When $\text{UO}_2(\text{NO}_3)_2$ is added to a solution of tartaric acid (I) the optical activity of (I) is enhanced. This is due to the formation of a complex of optical activity $<$ that of (I). The complex is photochemically reduced in the visible and ultra-violet regions. A three-stage reaction mechanism is proposed. C. R. H.

Photochemical chlorination and sulpho-chlorination of paraffin hydrocarbons in carbon tetrachloride solution. J. Stauff (*Z. Elektrochem.*, 1942, **48**, 550—559).—At $[\text{Cl}_2] > 0.008\text{M}$, the rate of chlorination of $\text{C}_{16}\text{H}_{34} \propto (I_{\text{abs.}} \times [\text{Cl}_2] \times [\text{C}_{16}\text{H}_{34}])^{0.5}$, where $I_{\text{abs.}}$ is the amount of light absorbed. At high $[\text{Cl}_2]$ the rate of chlorination $\propto I_{\text{abs.}} \times [\text{Cl}_2]$. The reaction products do not retard the reaction but O_2 has a strong retarding effect. It is inferred that the reaction occurs through initial formation of Cl atoms which react with $\text{C}_{16}\text{H}_{34}$ mols. to give HCl and $\text{C}_{16}\text{H}_{33}$ radicals. The latter react with Cl_2 mols. to form $\text{C}_{16}\text{H}_{33}\text{Cl}$ mols. and Cl atoms. Interaction of $\text{C}_{16}\text{H}_{33}$ radicals and Cl atoms causes a breaking of the reaction chain. The rate of photochemical interaction of C_7H_{16} or $\text{C}_{16}\text{H}_{34}$ with Cl_2 and $\text{SO}_2 \propto I_{\text{abs.}}^{0.5} \times [\text{paraffin}]$. It is inferred that the alkyl radicals formed as in the absence of SO_2 react to form the AlkSO_2 radical, which then reacts with Cl_2 mols. to form the sulphonyl chloride and a Cl atom. J. W. S.

Activation energy of the reaction $\text{CH}_3 + \text{HBr} = \text{CH}_4 + \text{Br}$ and carbon-hydrogen bond strength in methane. H. C. Andersen and G. B. Kistiakowsky (*J. Chem. Physics*, 1943, **11**, 6—10).—Measurements of the rate of formation of CH_4 on ultra-violet irradiation of MeI-HBr mixtures in presence of varying concns. of I have been used to calculate the relative rates of the reactions (i) $\text{Me} + \text{HBr} = \text{CH}_4 + \text{Br}$ and (ii) $\text{Me} + \text{I}_2 = \text{MeI} + \text{I}$. The activation energy of (i) is 1.5 kg.-cal., giving 102 kg.-cal. for Me-H bond energy by combination with van Artsdalen's data for the reverse reaction. L. J. J.

Photochemical reactions of the halogens with aliphatic compounds. II. H. J. Schumacher (*Angew. Chem.*, 1940, **53**, 501—505).—The following types of reaction are distinguished: (a) the conversion of a C-H into a C-Hal linking, and a C-Hal into a C-Hal' (change of halogen) (substitution); (b) the conversion of a C:C into the corresponding saturated linking (addition), and (c) the conversion of C:C into Hal:C:C:Hal. In all cases the primary reaction is the dissociation of the halogen into atoms. This takes place spontaneously, or after collision, according to the λ of the absorbed light. Reactions of each of the above types are considered in detail, and quantum yields and activation energies are given. If a mixture of a saturated and an unsaturated compound with Cl_2 is irradiated, the unsaturated compound is more rapidly attacked. A. J. M.

Photosensitisation by acetone of oxidation of methane.—See B., 1943, II, 101.

IX.—PREPARATION OF INORGANIC SUBSTANCES.

Distribution of isotopes of hydrogen and oxygen during freezing of water. R. V. Teis and K. P. Florenski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **32**, 199—202).—Initial stages of freezing of H_2O

give ice containing increased $[\text{H}^{18}\text{O}]$ and decreased $[\text{D}]$; as freezing progresses the ice approximates in composition to the water. The max. observed separation, in density units referred to liquid water, is $\Delta d_{180} = +14.6\gamma$ and $\Delta d_{\text{D}} = -8.0\gamma$, after freezing 4.5%. The effect is obscured by stirring, but is found in natural ice. L. J. J.

Reduction of sodium nitrate by calcium. A. Chrétien and Y. Longi (*Compt. rend.*, 1942, **214**, 669—670).—Equimol. mixtures of NaNO_3 and NaNO_2 are partly reduced by Ca at 250°. The max. yield of NaNO_2 is obtained by using 75% of the theoretical amount of Ca. Larger amounts of Ca reduce NaNO_2 to Na_2O . F. J. G.

Pyrolysis of some alkali and alkaline-earth salicylates in vacuo. M. Chaigneau (*Compt. rend.*, 1942, **214**, 671—673).—Mg, Ca, and Ba salicylates, but not $o\text{-OH}\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{Na}$ (I), evolve $\text{OH}\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{H}$ when heated, leaving basic salts. These, and (I), when further heated, evolve at first CO_2 , and then CO and H_2 . F. J. G.

Copper mirrors. P. W. Selwood (*J. Chem. Educ.*, 1942, **19**, 375).—The formation of a Cu mirror during the reduction of CuO by H_2 is due to the presence of HCl as impurity. This forms Cu_2Cl_2 , which volatilises and is reduced to Cu by H_2 . L. S. T.

Analogies of azide ion with the halogens. Copper azide. G. Denigès (*Compt. rend.*, 1942, **214**, 651—654).— Cu^{I} azide, CuN_3 , is prepared by adding 10% aq. CuSO_4 acidified with AcOH to a solution of NaN_3 and $\text{Na}_2\text{S}_2\text{O}_5$. It resembles CuCl . F. J. G.

Boric acid and hydroxy-compounds. III. Equilibrium between borate ion, pyrocatechol, and pyrocatechol borate ion in aqueous solution, and the preparation of monopyrocatechol borates. H. Schäfer (*Z. anorg. Chem.*, 1942, **250**, 127—144).—The equilibrium has been examined by means of potentiometric, cryoscopic, and solubility measurements. Provided that pyrocatechol (I) is not in excess, mono-(I) borates (II) are formed which are converted into di-(I) borates (III) as the concn. of (I) is increased. At 25° the ratio of the concn. of (III) ion to the concn. of (II) ion = $2.3 \times$ concn. of (I). The prep. of Li, Na, Sr, and Mg monopyrocatechol borate and of K, Na, and NH_4 dipyrocatechol borate by neutralising suitable (I)- H_3BO_3 mixtures with metal carbonates is described. The mono-salts have 3, 4, 8, and 8 mols. of H_2O of crystallisation respectively; the di-salts are anhyd. C. R. H.

Boric acid and hydroxy-compounds. I. Complex formation of boric acid with salicylic acid in aqueous solution.—See A., 1943, I, 92.

Laboratory synthesis of diamond. (A) F. A. Bannister and K. Lonsdale. (B) (Lord) Rayleigh (*Nature*, 1943, **151**, 334—335, 394).—(A) Hannay's "artificial diamonds" are shown by X-ray examination to be diamonds.

(B) It is believed that the "diamonds" did not burn in O_2 .

A. A. E.

Chromamines. II. Preparation of luteo-salts. C. L. Rollinson and J. C. Bailar, jun. (*J. Amer. Chem. Soc.*, 1943, **65**, 250—254).—Anhyd. 1:2-diamines react with anhyd. CrCl_3 , chrome alum, and $\text{Cr}_2(\text{SO}_4)_3$ to give luteo-salts; the prep. of $[\text{Cren}_3]\text{X}_3$ ($\text{X} = \text{Cl}$, Br , I , CNS) and $[\text{Crpn}_3]\text{X}_3$ ($\text{pn} = \text{propylenediamine}$, $\text{X} = \text{Br}$, I , CNS) is described. Attempts to prepare tri-trimethylenediamine-chromic salts were inconclusive. Ammonation under pressure of chloropentamminochromic salts increases with rising solubility in liquid NH_3 ($\text{Cl}' < \text{Br}' < \text{NO}_3'$). $[\text{Cr}(\text{NH}_3)_6](\text{NO}_3)_3$ is easily prepared by ammonation of $[\text{Cr}(\text{NH}_3)_5\text{Cl}](\text{NO}_3)_2$ at atm. pressure using NaNH_2 as catalyst. W. R. A.

Polymerisation of gaseous hydrogen and deuterium fluorides. R. W. Long, J. H. Hildebrand, and W. E. Morrell (*J. Amer. Chem. Soc.*, 1943, **65**, 182—187).—Association of gaseous HF and DF has been calc. from the deviations from linearity of the ratio of pressure to T at const. vol. for a range of temp. and pressures. Data agree well to the single equilibrium $6\text{HF} = (\text{HF})_6$ but there is some indication of lower polymerides at low degrees of association. The vals. of $\log K$ for $(\text{HF})_6$ and $(\text{DF})_6$ are given by $8910/T - 43.65$ and $8970/T - 43.65$, leading to $-40,800$ and $-41,100$ g.-cal. for corresponding heats of polymerisation. On the assumption that the polymeride is a single ring the energies of H- and D-bonds between F atoms are 6.80 and 6.85 kg.-cal. W. R. A.

Composition of chlorine hydrate. I. Harris (*Nature*, 1943, **151**, 309).—From heats of dissociation the formula of Cl hydrate is calc. as $\text{Cl}_2 \cdot 8\text{H}_2\text{O}$. A. A. E.

Behaviour of ferric hydroxide studied by the emanation method. II. Influence of small quantities of silicic acid. H. Götte (*Z. physikal. Chem.*, 1940, **B**, **45**, 216—228).—Emanation method investigations on changes in the structure of $\text{Fe}(\text{OH})_3$ show that this peculiar behaviour does not arise from the pptn. velocity of the $\text{Fe}(\text{OH})_3$ but from silicic acid, adsorbed by the $\text{Fe}(\text{OH})_3$, present during the ammoniacal pptn. Gel already separated and brought subsequently in contact with silicic acid exhibits the same effect. The characteristics of the effect are discussed. At 850—900° this effect is destroyed. Simultaneously the silicic acid appears to change and the $\text{Fe}(\text{OH})_3$ appears to act as mineralisator. The

curve obtained for $\text{Fe}(\text{OH})_3$ containing silicic acid is partly a superposition of the pure $\text{Fe}(\text{OH})_3$ curve and a SiO_2 curve. W. R. A.

X.—ANALYSIS.

Chemical war materials. XIV. Spectrophotometric determination of war materials. A. G. Epprecht (*Helv. Chim. Acta*, 1943, **26**, 56—60).—Errors in calculations made by Mohler and Sorge (cf. A., 1940, I, 145) are corr. C. R. H.

Thioflavine S as a luminescence indicator. E. A. Kocsis and G. Zádor (*Z. anal. Chem.*, 1942, **124**, 274—277).—0.2% aq. thioflavine S (I) (1—2 drops) can be used as a fluorescent indicator in acid-alkali titrations, its pH range being 3.1—4.4. In filtered ultra-violet light its fluorescence changes from bright blue in alkaline to dark blue in acid solution. (I) (20—25 drops) can also be used as adsorption indicator in titrating Ag^+ with halogen salts in neutral solution. The first few drops of halide solution extinguish the dark blue fluorescence of the indicator but at the end-point a bright blue fluorescence develops sharply. This indicator is suitable for use in the presence of coloured ions (Co^{++} , Ni^{++} , Cu^{++}). J. W. S.

Colorimetric determination of chloride ion. O. Hettche (*Z. anal. Chem.*, 1942, **124**, 270—274).—The method is suitable for the determination of >0.14 g. of Cl^- per l. The sample (25 c.c.) is treated with Fe alum solution (5 c.c.) and 0.01N- AgNO_3 (10 c.c.) and diluted to 50 c.c. The solution is filtered, 25 c.c. of the clear filtrate being collected, treated with 0.01N- NH_4CNS (5 c.c.), and diluted to 50 c.c. The solution is again filtered into a colorimeter cell and the intensity of the colour determined. The $[\text{Cl}^-]$ can then be deduced from calibration determinations. The Fe alum solution is prepared by mixing equal vols. of 20% aq. Fe alum and 10% HNO_3 . J. W. S.

Spectrographic detection and determination of the halogens. W. W. A. Johnson and D. P. Norman (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 119).—Materials containing halogens are sparked without prior chemical treatment in the usual high-voltage spectrographic spark. Masking of the most sensitive lines of Cl and Br by air lines is eliminated by using a cylindrical tube containing CO_2 . The limits of detection are Cl 0.5%, Br 0.3% (both in CO_2), F 0.1%, and I 0.07% (both in air). L. S. T.

Gravimetric determination of the fluoride ion. H. Krause (*Chem.-Ztg.*, 1942, **66**, 202—204).—The F^- is pptd. as CaF_2 by addition of an aq. suspension of $\text{Ca}(\text{OH})_2$ to the nearly neutral, boiling fluoride solution. Excess of $\text{Ca}(\text{OH})_2$ and pptd. hydroxides of other metals are dissolved by subsequent digestion with HCO_2H or, less suitably, AcOH . The liquid is filtered hot, with gentle suction; excessive washing of the ppt. is avoided. A correction for CaO in the ignited and weighed ppt. is determined by suspending the latter in H_2O and titrating (Me-orange) with 0.1N-HCl. Mg, Al, Zn, Ni, Co, and Cu do not interfere, but Fe, Mn, Ag, Hg, SO_4 , PO_4 , and SiO_3 must be removed (methods briefly described) before the determination. Full practical details and test data are given. The results shown are slightly low. A. J. E. W.

Determination of active oxygen in presence of barium or lead. M. Fleischer (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 31—32).—The method of Mrgudich and Clark (A., 1937, I, 426) is modified by substituting 5 vol.-% HClO_4 for the 50% acid, and by titrating with KMnO_4 instead of $\text{Ce}(\text{SO}_4)_2$ (electrometric). Procedure for Mn minerals containing Ba or Pb, or for PbO_2 and Pb_3O_4 , and test data, are given. A side reaction that consumes $\text{H}_2\text{C}_2\text{O}_4$ occurs when 30% H_2SO_4 is boiled with $\text{H}_2\text{C}_2\text{O}_4$ for 45 min. None occurs when 30 or 50% HClO_4 is heated with $\text{H}_2\text{C}_2\text{O}_4$ at $>95^\circ$. L. S. T.

Rapid determination of sulphuric and nitric acids in the presence of one another by conductometric neutralisation analysis. E. Sommer (*Z. anal. Chem.*, 1942, **124**, 283—287).—10 or 20 c.c. of the acid mixture ($\sim 0.1\text{N}$) is titrated to neutrality with 0.1N- $\text{Ba}(\text{OH})_2$ and, without removal of the pptd. BaSO_4 , the solution is diluted to 100 c.c. and its conductivity determined. The concns. of each acid can then be deduced from calibration curves or tables. J. W. S.

Accurate determination of sulphuric acid as barium sulphate. A. Krüger (*Z. anal. Chem.*, 1942, **124**, 85—92).—Details of a method designed to compensate for the low and high vals. due to the presence of Na_2SO_4 and of BaCl_2 , respectively, in the BaSO_4 are given. The neutral solution, freed from NH_4 and from heavy metals by boiling with Na_2CO_3 , is mixed with suitable amounts of NaCl and HCl , and divided into 2 approx. equal parts. The first part is pptd. in a special way by means of a large excess of 2.5% aq. $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$, and then the second part is added. Test data are recorded. L. S. T.

Photo-colorimetric study of the oxidation of nitric oxide at low pressures. J. H. Smith (*J. Amer. Chem. Soc.*, 1943, **65**, 74—78).—A sp. colorimetric method for detecting NO_2 is described and used over a 100-fold NO_2 concn. range from 0.5 to 50 mm. at 0° and 25° . At very low pressures adsorption and surface effects influence the reaction rate considerably. The oxidation of NO is essentially

homogeneous in absence of adsorption effects. Addition of NO to a tube containing O_2 leads to reaction, contrary to the observation of Stoddart (A., 1939, I, 148). W. R. A.

Determination of phosphorus by precipitation as ammonium phosphomolybdate. Influence of the treatment of the precipitates in filtering and washing and the air dilution during drying of the acetone-treated precipitate. W. Spengler (*Z. anal. Chem.*, 1942, **124**, 241—260; cf. A., 1938, 269).—When the ppt. obtained by treating the solution containing PO_4^{3-} with $(\text{NH}_4)_2\text{MoO}_4$ in acid solution is washed with COMe_2 and dried at 15—20 mm. (H_2O -pump) it has the composition $[(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3]_8 \cdot [\text{NH}_4\text{HMoO}_4 \cdot \text{H}_2\text{MoO}_4]_4 \cdot (\text{NH}_4\text{HMoO}_4) \cdot 24\text{H}_2\text{O} \cdot 5\text{COMe}_2$. The conditions of pptn. can be varied considerably without affecting the results but the conditions of washing the ppt. with NH_4NO_3 and of drying should not be varied. The preferred method for the determination is detailed. J. W. S.

Titration precipitated arsenic. W. J. Agnew (*Analyst*, 1943, **68**, 111).—The As pptd. by boiling with HCl and NaH_2PO_2 was collected on purified asbestos and dissolved in an excess of 0.01N- $\text{K}_2\text{Cr}_2\text{O}_7$ containing H_2SO_4 . The excess of $\text{K}_2\text{Cr}_2\text{O}_7$ was determined by adding aq. $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ and titrating back with KMnO_4 and disulphine-blue. S. B.

Colorimetric determination of boron. D. Dickinson (*Analyst*, 1943, **68**, 106—109).—(a) The quinalizarin method (cf. A., 1936, 42; 1941, I, 386) is modified by matching the colour produced in 15 min. with that of a standardised solution containing known amounts of Na_2CO_3 , phenolphthalein, and thymolphthalein. (b) The colour produced in 30 ± 2 min. in H_2SO_4 (≤ 94.5 wt.-%) with alizarin S is compared with that of a dil. EtOH solution of Me-orange. The colour $\propto [\text{H}_2\text{SO}_4]$; F^- and NO_3^- interfere. B in plant material is determined after dissolution of the ash in H_2SO_4 . S. B.

Fluorescence reaction for the detection of boric acid. K. Neelakantam and L. R. Row (*Proc. Indian Acad. Sci.*, 1942, **16**, A, 349—358).—The interference of cations and anions on the fluorescence produced in the reaction of boric acid with resacetophenone and H_3PO_4 has been investigated. CrO_4^{2-} , BrO_3^- , ClO_3^- , NO_2^- , and F^- ions interfere slightly. The method is applicable for the detection of micro-quantities. W. R. A.

Micro-determination of carbon in steels.—See B., 1943, I, 210.

Analysis for potassium by its natural radioactivity. R. B. Barnes and D. J. Salley (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 4—7).—Apparatus and method for determining $[\text{K}^+]$ in a solution by means of a Geiger counter tube are described. The ρ of a solution may affect the counting rate and a correction must then be made. L. S. T.

Spectrographic limit of identification of potassium. D. P. Norman and W. W. A. Johnson (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 152—153).—The limits of detection of K in the d.c. current arc for the doublets 4044—4047 Å. and 7664—7698 Å. have been investigated for 6 K salts and 4 compounds containing K as a minor impurity. The limit of detection of the 4000 Å. doublet varies from 10 to 300 μg ., and for the 7600 Å. doublet from 0.04 to 0.8 μg ., depending on the nature of the material investigated. L. S. T.

New reagents for sodium. E. R. Caley and L. B. Rogers (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 32—36).—The aq. Cu UO_2^{++} acetate reagent described previously (A., 1940, I, 80) is not satisfactory for the determination of Na^+ . An EtOH-reagent is preferred, and gives a ppt. with 0.1 mg. of Na^+ , but none with 50 mg. of Li^+ , when 20 ml. are used. Anions that ppt. Cu^{++} or UO_2^{++} must be absent, and free mineral acid reduces sensitivity. The reagent must be protected from light. The ppts. produced by this reagent contain ~ 1.5 mols. of EtOH and 4.5—5 of H_2O (cf. Schoorl, *Rec. trav. chim.*, 1940, **59**, 305). Application to the determination of Na^+ in presence of Li^+ , and typical analyses, are described. Reagents prepared from UO_2 and Mg chloroacetates, formates, propionates, and butyrates are not suitable for detecting or determining Na^+ . The butyrate is a selective, but not sensitive, reagent for K^+ . L. S. T.

Ultra-micro-method for sodium employing the polarograph. C. Carruthers (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 70—71).—Solutions of Na Zn UO_2 acetate (I) in 0.5N-HCl give well-defined diffusion currents which are directly $\propto [\text{I}]$. The application of the polarograph technique to the determination of <1 mg. of Na^+ in limited amounts of biological material is detailed. L. S. T.

[Colorimetric] determination of an alkali carbonate in presence of an alkali hydrogen carbonate. W. T. Sumerford with D. Dalton and R. Johnson (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 38—39).—The red colour obtained with Na_2CO_3 and *p*-nitrosothymol serves to detect Na_2CO_3 in presence of NaHCO_3 . A method for its colorimetric determination has been worked out. Comparison with volumetric methods shows that the method is most accurate for small amounts of CO_3^{2-} in presence of much HCO_3^- . L. S. T.

Determination of alkalis in glass.—See B., 1943, I, 203.

Chemistry of group I. Silver, mercury, and lead. A. B. Garrett, M. V. Noble, and S. Miller (*J. Chem. Educ.*, 1942, **19**, 485—489).—

Recent research concerning the chemical facts and principles involved in the qual. analysis of this group is summarised.

L. S. T.

Determination of calcium as tungstate. A. Ievinš and V. Grinšteinš (*Z. anal. Chem.*, 1942, 124, 288—300).—The wt. and composition of the ppt. formed on treating solutions containing Ca^{++} with Na_2WO_4 vary with the $[\text{OH}^-]$. Const. results are obtained if the CaWO_4 is pptd. with 100% excess of Na_2WO_4 in neutral or slightly ammoniacal solution and then heated at 800—900°, but even under such conditions the wt. of the ppt. is slightly > the theoretical amount. Owing to the relatively high solubility of CaWO_4 this method cannot be used for separating Ca and Mg.

J. W. S.

Separation of calcium from magnesium by the oxalate process. Z. Karaoglanov (*Z. anal. Chem.*, 1942, 124, 102—110).—Data for the pptn. of Ca^{++} by $(\text{NH}_4)_2\text{C}_2\text{O}_4$ alone and in presence of Mg^{++} are recorded and discussed. For the pptn. of Ca^{++} , the results are independent of speed of pptn., temp., and time of keeping (1 or 12 hr.). The tendency of CaC_2O_4 to form supersaturated solutions is without marked effect so long as the ppt. is kept for <1 hr. before filtration. When Ca^{++} is pptd. at room temp. and filtered after 1 hr. the separation of different quantities of Ca^{++} from Mg^{++} in a total vol. of 200 c.c. is satisfactory. $[\text{NH}_3]$ has little effect on the results, and $[\text{NH}_4\text{Cl}]$ can vary between wide limits. Pptn. in presence of NH_4Cl helps to overcome the disadvantage of the fineness of particle-size of CaC_2O_4 pptd. in the cold. The solubility of MgC_2O_4 and the stability of its supersaturated solutions decrease when the excess of $(\text{NH}_4)_2\text{C}_2\text{O}_4$ is not large. The cause of the contamination of CaC_2O_4 by Mg^{++} is discussed.

L. S. T.

Semi-micro-scheme of qualitative analysis. J. T. Dobbins and J. A. Southern (*J. Chem. Educ.*, 1942, 19, 479—482).—Separations into the usual groups are described. Mg^{++} is included with Ca^{++} , Ba^{++} , and Sr^{++} , which are pptd. as phosphates from alkaline solution. Colour reactions are used for confirmatory tests.

L. S. T.

Determination of magnesium in the fog nuclei and precipitations of the atmosphere. H. Cauer and G. Cauer (*Z. anal. Chem.*, 1942, 124, 81—85).—Details for determining H_2O -sol. Mg^{++} in artificially-collected dew by means of the blue colour obtained with quinalizarin, using drop-reaction technique, are given. Data are recorded.

L. S. T.

Sensitivity of chemical reactions. Sensitivity of the reaction $\text{Mg}^{++} + \text{C}_2\text{O}_4^{--}$. Z. Karaoglanov (*Z. anal. Chem.*, 1942, 124, 92—102).—The sensitivity of this reaction depends markedly on the reaction time, and decreases strongly with an increase in concn. of reagent. The presence of NH_4Cl , NH_3 , or AcOH has no great effect on the pptn. of MgC_2O_4 . Warming, seeding with $\text{Mg}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ or $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$, and rubbing with a glass rod accelerate crystallisation. Data for the solubility of $\text{Mg}_2\text{C}_2\text{O}_4$ in H_2O show that solubility slightly decreases with time and tends to reach a const. val. In presence of $(\text{NH}_4)_2\text{C}_2\text{O}_4$, solubility increases rapidly. The peculiarities shown by the reaction $\text{Mg}^{++} + \text{C}_2\text{O}_4^{--}$ are due to the strong tendency of $\text{Mg}_2\text{C}_2\text{O}_4$ to form stable, supersaturated solutions.

L. S. T.

Spectrophotometric determination of magnesium [in water] by Titan-yellow.—See B., 1943, III, 91.

Photometric routine determination of traces of lead by dithizone. Application to materials used in the manufacture of cosmetics. J. Schultz and M. A. Goldberg (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 155—158).—The procedure described is accurate to 1—2 μg . of Pb. Application of the method to MgCO_3 , ZnO , Zn stearate, cosmetic ochres, CaCO_3 , TiO_2 , talc, kaolin, and BaSO_4 is described. Al and Ti both interfere with the extraction of Pb by dithizone.

L. S. T.

Photographically interesting fine chemicals as specific spot test reagents. A. Steigmann (*J.S.C.I.*, 1943, 62, 42—43).—Thiocarbonyl is a sp. spot test reagent for Pb and 2-thiolbenzimidazole is sp. for Pd and highly selective for Bi. 2:3-Dihydroxyquinoxaline in slightly alkaline solution is a group reagent for the alkaline earths and can be made sp. for Ba and Ca. The dioxime of chromotropic acid or its tautomeride 2:7:1:8:3:6-(NO) $_2$ C $_{10}$ H $_2$ (OH) $_2$ (SO $_3$ H) $_2$ is a very sensitive sp. reagent for Co and highly selective for Ni and Cu.

Reactions of cations. IX. Reactions of thallium cations. P. Wenger and R. Duckert [with (Mlle.) Y. Rusconi] (*Helv. Chim. Acta*, 1943, 26, 338—345).—Reactions of Tl are tabulated with indications of their degrees of usefulness in macro- and micro-analysis.

C. R. H.

Colorimetric determination of copper with 1:10-phenanthroline. M. L. Moss with M. G. Mellon (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 116—118).—The brown colour of Cu^{++} -phenanthroline complex, obtained by treating $\text{Cu}(\text{NH}_3)_4^{++}$ with α -phenanthroline followed by reduction with NH_2OH , is used as the basis of a colorimetric method for determining Cu. Beer's law is valid over the range of Cu used (0.5—10 p.p.m.), and in presence of "methylcarbitol," which prevents pptn., the colour system is stable for <24 hr. Metals that ppt.

with aq. NH_3 are removed during the course of the procedure, and, of the metals of which compounds are sol. under the conditions used, only Cd, Co, Ni, and Zn interfere, presumably by complex formation with the reagent. CN^- , $\text{S}_2\text{O}_3^{--}$, and large amounts of $\text{Cr}_2\text{O}_7^{--}$ and VO_3^- must be absent.

L. S. T.

Direct spectrographic determination of copper and manganese in dyes.—See B., 1943, II, 110.

Specific tests for mercury with dithizone membrane papers. A. Steigmann (*J.S.C.I.*, 1943, 62, 43—44).—The technique depends on the fact that H_2O -permeable, dry acetylcellulose membranes containing dithizone cause a capillary separation of heavy metal ions in acid or alkaline solutions, some metals giving strong and others more or less diffuse reactions at the centre of the test spot on the membrane, whereas a third group gives reactions only in the outer margins of the spot. A special dithizone membrane paper almost impermeable to ions has been found to react specifically with HgCl_2 .

Nitrophenylallylthiosemicarbazides. Analytical properties.—See A., 1943, II, 128.

Determination of low alumina contents in steel by spectrum analysis.—See B., 1943, I, 210.

Polarographic determination of manganese as tri-dihydrogen pyrophosphatomanganate. I. M. Kolthoff and J. I. Watters (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 8—13).— Mn^{++} is oxidised quantitatively to the tervalent state by means of PbO_2 in presence of a large excess of $\text{K}_4\text{P}_2\text{O}_7$ at pH 2.0—4.0 (HNO_3 or H_2SO_4), and the $[\text{Mn}^{+++}]$ determined polarographically. The violet coloured ion has the structure $[\text{Mn}(\text{O}=\text{P}(\text{OH})_2)_3]^{+3}$. The effect of various factors on the determination is detailed.

L. S. T.

Separation of iron from cobalt or nickel. R. J. DeGray and E. P. Rittershausen (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 26—27).—Addition of $\text{H}_2\text{C}_2\text{O}_4$ before pptn. of $\text{Fe}_2\text{O}_3 \cdot n\text{H}_2\text{O}$ by aq. NH_3 prevents co-pptn. of Co^{++} or Ni^{++} when the ratio of Co or Ni to Fe is >10:1. Small amounts of Fe^{+++} escape pptn., but do not interfere with the subsequent colorimetric determination of Co^{++} as ferricyanide. 0.1% of Co in steel can be determined by this method, details of which are given. If necessary the ratio of Fe^{+++} to Co^{++} or Ni^{++} is reduced by extracting FeCl_3 with Et_2O .

L. S. T.

Spectrophotometric determination of iron [in ores] with α -phenanthroline and nitro- α -phenanthroline.—See B., 1943, I, 206.

Colorimetric determination of cobalt with tripyridyl. M. L. Moss with M. G. Mellon (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 74—75).—The orange colour formed by Co^{++} and tripyridyl [2:6-di-2'-pyridylpyridine] (I) is used. Beer's law holds for concns. from 0.5 to 50 p.p.m., and variations in pH between 2 and 10 are without effect. Interference by most common ions except Cu, Ni, and Fe is not serious. CN^- and $\text{Cr}_2\text{O}_7^{--}$ must be absent. Fresh colour standards must be prepared daily. Nitroso-R-salt requires a more careful control of pH, and the colour is no more stable than that obtained with (I).

L. S. T.

Concentration methods in spectrographic analysis. I. Recovery of cobalt, nickel, molybdenum, copper, and zinc from plant materials and soil extracts by 8-hydroxyquinoline.—See B., 1943, III, 69.

Rapid photometric determination of cobalt in steels using nitroso-R-salt.—See B., 1943, I, 210.

Rapid photometric determination of cobalt in steel and ferrocobalt.—See B., 1943, I, 210.

Separation of nickel and cobalt from iron and of nickel from cobalt. B. S. Evans (*Analyst*, 1943, 68, 67—70).—Ni and Co together with a trace of Fe are pptd. as cobalticyanides and converted into the hydroxides, the Ni and Co being determined by titration with aq. KCN and aq. AgNO_3 . Ni is determined separately, after conversion of the Co into cobalticyanide. When it is necessary to determine the Ni and Co in one solution the Ni is separated as the dimethylglyoxime compound, the Co pptd. as Cu cobalticyanide, the Cu removed as CuS , and the Co determined by titration with aq. KCN.

S. B.

Solubility of nickel dimethylglyoxime in alcoholic solution in determination of nickel.—See B., 1943, I, 212.

Detection and determination of small amounts of molybdenum [in paint pigments].—See B., 1943, II, 124.

Electrographic detection of molybdenum in steel alloys.—See B., 1943, I, 210.

Analytical chemistry of tungsten. II. Separation of tungstic and phosphoric acids. D. A. Lambie (*Analyst*, 1943, 68, 74—77; cf. A., 1939, I, 490).— α -Toluidine does not accomplish a quant. separation of tungstic (I) and phosphoric (II) acids. When the phosphomolybdate complex is decomposed by excess of aq. NH_3 , (II) is completely pptd. by excess of magnesia mixture and (I) may then be determined in the filtrate by pptn. with tannin-cinchonine.

Under the same conditions the latter method gives complete separation of (I) from (II). S. B.

Spectrochemical assay for traces of tungsten. A. G. Scobie (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 79—80).—A spectrographic procedure is described. The method depends on the W-collecting properties of $\text{Al}_2\text{O}_3 \cdot n\text{H}_2\text{O}$ pptd. by aq. NaHCO_3 in presence of W. 0.00002% of W in an ore or concentrate can be determined. Details of procedure for collecting W from ores are given. L. S. T.

Detection of zirconium with 5-chlorobromamine acid. J. H. Yoe and L. G. Overholser (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 73).—5-Chlorobromamine acid [Na 5-chloro-4-bromo-1-aminoanthraquinone-2-sulphonate] (2 mg. per ml. of (1:1) H_2O - $\text{C}_2\text{H}_5\text{OH}$) is used in presence of HNO_3 as a drop reagent for Zr (<2 p.p.m.). PO_4^{3-} and SO_4^{2-} prevent formation of the red ppt. F⁺ must also be absent. Interferences due to other ions are recorded. In ammoniacal solution, the chlorobromamine acids give heavy red ppts. with Cd^{2+} , Cu^{2+} , Co^{2+} , Ni^{2+} , Pd^{2+} , and Zn^{2+} . L. S. T.

Colour reactions for the detection of antimony, gallium, and other elements. V. I. Kuznetsov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 33, 45—47).—The colour reactions of Sb, Al, Ga, Bi, Fe⁺⁺⁺, Ti⁺⁺⁺, Zr, Th, and Sn⁺⁺⁺ with 4-nitro- and 4-nitroso-pyrocatechol, alizarin, $p\text{-SO}_3\text{H}\cdot\text{C}_6\text{H}_4\cdot\text{N}_2\cdot\text{C}_6\text{H}_4(\text{OH})_2$ 3:4, and $p\text{-SO}_3\text{H}\cdot\text{C}_6\text{H}_4\cdot\text{N}_2\cdot\text{C}_6\text{H}_4(\text{OH})_2$ 1:3:4 are recorded for solutions acidified with 0.1N-, 0.5N-, and N-HCl. A. J. M.

Organic analytical reagents containing sulphur. A. K. Majumdar (*J. Indian Chem. Soc.*, 1942, 19, 396).—The red ppts. given by dithiolthiodiazole and phenyldithiodiazolonethiol with Bi compounds can be peptised by a solution of gum acacia, thus enabling colorimetric determinations of Bi to be made. In very dil. HNO_3 Bi can be detected at a dilution of 1 in 6×10^6 . C. R. H.

XI.—APPARATUS ETC.

Simplified electronic thermoregulator. W. E. Gilson and H. A. Wooster (*J. Chem. Educ.*, 1942, 19, 531—532). L. S. T.

Suspension of glass thermometers. G. Bona and R. Rowe (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 7).—Rubber tubing with a small hole near the top is fitted on to the top of the thermometer. L. S. T.

Bath for use in the graduation and testing of thermometers. A. Grace and J. A. Hall (*J. Sci. Instr.*, 1943, 20, 60—63).—The stirred-liquid bath employs a circulating pump which operates at air temp. By using various liquids the range -70° to 630° can be covered to $\pm 0.05^\circ$ at 450° . A. A. E.

L.T. air-circulated constant-temperature oven. R. B. Brock (*Chem. and Ind.*, 1943, 133—139).— H_2O is circulated rapidly through a jacketed oven measuring $3 \times 2 \times 2$ ft. and functioning at $150 \pm 0.5^\circ \text{F}$. The air inside the oven is circulated over each shelf in turn. Temp. control is situated in the H_2O jacket. S. B.

Vacuum spectroscopy. H. Bomke (*Naturwiss.*, 1942, 30, 650—659).—A progress report dealing with spectroscopy in the far ultra-violet and soft X-ray regions. A. J. E. W.

Curvature of the lines in plane-grating spectra. R. Minkowski (*Astrophys. J.*, 1942, 96, 306—308).—The curvature is opposite to that in the prismatic spectrum; the apices of the lines, which are parabolas, point towards the violet. The apparent difference in λ at a height y from the centre, and at the centre of the spectrum, is $d\lambda = 0.5\lambda(y^2/f^2)$; f is the focal length of the camera. E. R. R.

Spectrographic analysis. Photographic aspects of the internal standard method. II. Theoretical factors governing plate calibration. E. H. Amstein (*J.S.C.I.*, 1943, 62, 51—58; cf. A., 1943, I, 156, 250).—Various methods of plate calibration are considered with special reference to the use of relative intensities. It is shown how analysed standard alloys can be eliminated from plates calibrated in terms of relative intensities, a method which also provides freedom from photographic restrictions. Some of the ways of obtaining known relative intensities are then considered with special reference to the rotating stepped sector, stepped optical wedge, and the use of lines in a simple spectrum which have known, or previously determined, relative intensities ("internal line-group method"). The effect of reciprocity failure on each of these methods is discussed, together with any special precautions which are necessary. Suitable light sources are given. The reproducibilities of the three methods of obtaining relative intensities are given. The emulsion used (Ilford Ordinary) exhibited reciprocity failure ($p = 0.91$). The fusion frequency of a ratio 2 stepped sector is found to be 80 r.p.m., and a method for estimating the magnitude of stroboscopic effects with a spark source is given. Examples of plate calibration using relative intensities, and a discussion of its advantages, are appended.

Null-reading photo-electric micro-densitometer for use in turbidimetry and abridged spectro-photometry. J. C. Baier, jun. (*Ind.*

Eng. Chem. [Anal.], 1943, 15, 144—148).—Construction, operation, and performance are described. 1-ml. samples are needed for all determinations. L. S. T.

Setting the Spekker absorptiometer. J. H. High (*Analyst*, 1943, 68, 78).—The use of a neutral filter for setting the instrument is recommended. S. B.

Filter photometry. M. C. Schwartz and L. W. Morris (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 20—23).—The filter photometer, its operation, and its application to the silicomolybdic colour reaction are described. L. S. T.

Photo-electric fluorimeter. R. P. Krebs and H. J. Kersten (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 132—133). L. S. T.

Electrical screening of sparking apparatus for use in spectrographic analysis. D. M. Smith and A. Walsh (*J. Sci. Instr.*, 1943, 20, 63—64).—A method which satisfies Post Office requirements is described, and test data are given. A. A. E.

New electrophoresis apparatus for preparative purposes. H. Svensson (*Arkiv Kemi, Min., Geol.*, 1942, 15, B, No. 19, 8 pp.).—An electrophoresis apparatus large enough to carry out separations on the preparative scale is described. A. J. M.

Simplified electro-osmosis apparatus. J. D. Porter (*J. Chem. Educ.*, 1942, 19, 533—536). L. S. T.

Versatile continuous-reading thermionic voltmeter. L. J. Anderson [with J. C. Hindman] (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 42—45).—A thermionic voltmeter suitable for a wide range of laboratory measurements in high- and low-resistance circuits is described. L. S. T.

Simple electric relay. E. B. Working (*Science*, 1942, 96, 281). E. R. R.

Two new hot-filament resistances. C. C. Minter (*J. Appl. Physics*, 1943, 14, 49—50).—A negative temp. coeff. of resistance (δ) in a hot filament can be simulated by mounting it in a gaseous atm. the thermal conductivity (κ) of which increases with ambient temp. (θ), e.g., an evacuated tube containing liquid H_2O . The reverse effect, giving an apparent δ 3—4 times normal, is obtained by adding H_2 , κ of the resulting H_2 - H_2O vapour mixture decreasing with θ . L. J. J.

Surface area of oxide-coated cathodes by adsorption of gas at low pressures. L. A. Wooten and C. Brown (*J. Amer. Chem. Soc.*, 1943, 65, 113—118).—The area of the oxide coating has been determined from the adsorption isotherms for C_2H_4 at -183° and -196° and C_4H_{10} at -116° on oxide-coated cathodes. The area is ~ 10 sq. cm. per mg. The adsorption isotherms closely resembled those near the b.p. although condensation pressures were <0.1 mm. The adsorption of C_2H_4 at -183° on alkaline-earth oxides showed an abrupt rise in the pressure range 0.25 — $0.30p_0$ ($p_0 = \text{v.p. of the condensed phase of the gas at the adsorption temp.}$), but this is not exhibited with the carbonates. W. R. A.

Electrostatic focussing of high-speed ion and electron beams. J. D. Craggs (*J. Appl. Physics*, 1942, 13, 772—780).—Tests of electrostatic lens systems for focussing a beam of 10—30-kv. H^+ ions from a canal-ray source are described. $<50\%$ of the ion beam can be focussed into an area 1—2 cm. diameter at 20—50 cm. from the source. The behaviour and efficiency of cascade acceleration tubes are discussed. L. J. J.

Preparation and efficiency of fast Geiger-Müller counter. G. D. Rochester and L. Jánosy (*Physical Rev.*, 1943, [ii], 63, 52—54).—The prep. of a large no. of counters in anticoincidence and the measurement of their efficiencies are described. No change is found in the efficiency of an A-EtOH counter when the pressure of the A is changed from 11 to 74.5 cm. No special treatment of the counter sheath is necessary. N. M. B.

Fine structure of metallic surfaces with the electron microscope. R. D. Heidenreich and V. G. Peck (*J. Appl. Physics*, 1943, 14, 23—29).—In the method described, a positive transparent replica of a metal surface is produced by moulding polystyrene on to the surface at 130 — 160° and 2000—5000 lb. per sq. in., detaching the metal from the mould, and vaporising SiO_2 on to the mould surface in vac. The SiO_2 deposit is sufficiently mobile on polystyrene to form a positive replica of the original with electron-optically smooth outer surface; this is detached from the mould with EtBr and shows surface features of the original in the electron microscope with resolution $\sim 50 \text{ \AA}$. L. J. J.

Electrostatic electron microscopy. I. C. H. Bachman and S. Ramo (*J. Appl. Physics*, 1943, 14, 8—18).—General constructional characteristics of electron sources and electrostatic lenses applicable to the electron microscope are discussed. Methods of computation of focal properties and aberrations are described. L. J. J.

Emission electron microscopy with magnetic lenses. E. Kinder (*Naturwiss.*, 1942, 30, 591—592).—An objective for use with the magnetic emission electron microscope is described. A. J. M.

Magnetic separation of diamagnetic or paramagnetic substances. A. Cotton and B. Tsai (*Compt. rend.*, 1942, 214, 753—756).—Data are tabulated for 20 powdered substances (metals, minerals, and salts), diamagnetic or weakly paramagnetic, in a strongly paramagnetic liquid (O_2) in a vac. vessel between the poles of a powerful electromagnet. The relation of field strength to the d and susceptibility of the substance is examined. Comparative data when liquid O_2 is replaced by conc. $Mn(NO_3)_2$ solution are given. N. M. B.

Simple automatic and recording balance. N. W. Muller and R. E. Peck (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 46—48).—The construction and operating characteristics of a rugged type of balance, suitable for chemical engineering laboratory operations where a continuous record of sample wt. is required over long periods of time, are described. L. S. T.

Electromagnetically-compensated micro-balance. P. Manigault and B. Tsai (*Compt. rend.*, 1942, 214, 658—660).—Apparatus is described. F. J. G.

Computing scales for calculating percentage deviation from average weight. T. I. Edwards (*Science*, 1942, 95, 50—51). E. R. R.

Modification of calibration apparatus. W. R. Thompson (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 118; cf. A., 1942, I, 281). L. S. T.

Micrometer burette. R. B. Dean and E. S. Fletcher, jun. (*Science*, 1942, 96, 237—238).—The instrument sketched and described overcomes the difficulties of cleaning and of reaction with Hg. E. R. R.

Automatic burette for dispensing volatile reagents. J. W. Murray (*J. Chem. Educ.*, 1942, 19, 516). L. S. T.

The microvol; apparatus for measuring small volumes of gas. R. T. Sanderson (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 76).—The apparatus described measures vols. of 0.01 cu. mm. to several ml., and has several advantages over the McLeod gauge. L. S. T.

Corrector bar mechanism applied to a densitometer. G. F. G. Knipe (*J. Sci. Instr.*, 1943, 20, 64—65).—The construction of a new scale when the neutral wedge of a photo-electric densitometer ages, or if the lamp or photocell is changed, is avoided by fitting a corrector bar. A. A. E.

Apparatus for the kinetic investigation of very rapid homogeneous gas reactions. I. II. Mixing fields between different rapid concentric gas streams. G. Damköhler and A. Sander (*Z. Elektrochem.*, 1942, 48, 523—543, 544—550).—I. An apparatus in which reactant gases are heated separately in concentric tubes, allowed to mix under carefully controlled conditions in a reaction vessel, and then chilled is described. The apparatus permits reduction of the time of reaction to 10^{-1} — 10^{-4} sec. and the reaction products and intermediate products can be isolated. Temp. are measured by small Pt/Pt-Rh thermojunctions and the gas mixtures may be analysed by thermal conductivity measurements.

II. The rapidity of mixing of two concentric gas streams of different velocities has been studied, using an outer stream of O_2 of uniform velocity 5 cm. per sec. and an inner stream of CO_2 of variable velocity w_2 . With $w_2 > 400$ cm. per sec. mixing occurs smoothly in the manner of ordinary diffusion. At higher velocities the mixing is more irregular and at $w_2 > 1700$ cm. per sec. it becomes turbulent. With this apparatus the pre-heating time of the gas can be reduced to 2×10^{-2} sec., thus permitting the use of thermally unstable reactants. J. W. S.

Device for calibrating small air pumps. J. C. Owen (*Science*, 1943, 97, 99—100).—Apparatus for calibrating a reciprocating pump of ~5 c.c. capacity is described. E. R. R.

Simple ultracentrifuge with plastic rotor. K. G. Stern (*Science*, 1942, 95, 561—562).—Vertical, cylindrical, air turbine ultracentrifuges of 2 in. and 6 in. diameter and ~0.5 in. thickness were constructed from polystyrene and polyacrylic transparent resins. The smaller machine was capable of ~58,000 r.p.m. E. R. R.

Surface tension apparatus. H. Mohler and J. Hartnagel (*Helv. Chim. Acta*, 1943, 26, 155—156).—An improved form of an earlier apparatus is described (cf. A., 1940, I, 150). C. R. H.

Measurement of the surface tension of liquids by the method of vibrating jets. G. Littaye (*Compt. rend.*, 1942, 214, 760—762).—A modification of the optical method of determining the λ of the vibration is described. N. M. B.

Rapid method of dialysis. R. C. Rose (*J.S.C.I.*, 1943, 62, 44).—Dispersed solids are surrounded by Na alginate solution, which is subsequently coagulated by $CaCl_2$ to give a semi-permeable membrane around the particles.

Fractional distillation micro-apparatus. C. Tiedcke (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 81—82). L. S. T.

Modified stock valve [with one sintered-glass disc]. E. Warrick and P. Fugassi (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 13). L. S. T.

Adsorption analysis by interferometric observation. A. Tiselius and S. Claesson (*Arkiv Kemi, Min., Geol.*, 1942, 15, B. No. 18, 6 pp.).—A micro-interferometer for adsorption analysis in H_2O or org. solvents is described. The graph of n against vol. gives a step-like diagram, each step corresponding to a component. A. J. M.

Thimble supports for faster Soxhlet extraction. W. C. Tobie (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 122). L. S. T.

Constant pressure and flow ratio regulator for continuously mixing two gases. N. L. Heikes (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 133—134). L. S. T.

Vacuum take-off receiver for solids. J. B. Hyman (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 90).—The receiver described is suitable for distillates of $C_{10}H_8$, Ph_2 , anthracene, and phenanthrene. L. S. T.

Silver membranes. F. A. Santalov (*J. Phys. Chem. Russ.*, 1941, 15, 807—810).—Sheets of 23 : 77 and 1 : 3 Zn-Ag alloy are heated at 700° in order to remove Zn; the diameter of the pores of the resulting Ag membranes \propto thickness of the original sheets. R. T.

Analytical patterns in the study of mineral and biological materials. H. Yagoda (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 135—141).—A review and classification of analytical patterns produced by physical methods such as the auto-radiograph, auto-luminograph, and magnetograph, and by chemical methods such as the contact print and electrographic print methods. L. S. T.

Nomograph for emergent-stem correction of mercury-in-glass thermometers. J. G. Kane and H. A. Schuette (*Oil and Soap*, 1943, 20, 11—12).—The construction of a convenient nomograph for the accurate determination of the stem correction for F. or C. thermometers over the range 0 — 300° C. is described. E. L.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Lecture demonstrations. J. H. Walton (*J. Chem. Educ.*, 1942, 19, 453—457).—Demonstrations of the explosion of H_2 and Cl_2 , and of H_2 and O_2 , the reduction of CuO , partial miscibility, oxidation of Al, the solubility of gases, production of H_2O from burning H_2 , etc. are described and illustrated. L. S. T.

Projection manometer for lecture demonstrations. J. W. Moore and C. M. Furgason (*J. Chem. Educ.*, 1942, 19, 513). L. S. T.

Apparent degree of ionisation of hydrochloric, sulphuric, and acetic acids. Electrical conductivity experiment. L. E. West and A. Gahler (*J. Chem. Educ.*, 1942, 19, 366—368). L. S. T.

Lecture demonstration of X-rays and cathode rays. C. L. Christ (*J. Chem. Educ.*, 1942, 19, 548). L. S. T.

Carl Wilhelm Scheele (1742—1786). K. R. Webb (*Chem. and Ind.*, 1943, 139—141).

Rutherford: life and work to 1919. H. R. Robinson (*Proc. Physical Soc.*, 1943, 55, 161—182).

Otto Ruff. R. E. Oesper (*J. Chem. Educ.*, 1942, 19, 496). L. S. T.

Richard Willstätter. R. Adams (*J. Amer. Chem. Soc.*, 1943, 65, 127—128).—Obituary notice. W. R. A.

A. N. Bach's scientific work. A. I. Oparin and N. M. Sisakjan (*J. Phys. Chem. Russ.*, 1941, 15, 697—707).—A review. R. T.

XIII.—GEOCHEMISTRY.

Chemistry of the atmosphere of Venus. R. Wildt (*Astrophys. J.*, 1942, 96, 312—314).—Since the vapour of polyoxymethylene hydrates is chiefly CH_2O , the author retracts his earlier theory of the nature of the atm. of Venus. It is suggested that all H_2O in Venus may be bound in hydrated minerals. E. R. R.

Differential density of ground water in ore deposition. (A) E. T. McKnight. (B) D. J. Cederstrom. (C) J. S. Brown (*Econ. Geol.*, 1942, 37, 424—426, 524, 639—640).—Comments (cf. A., 1943, I, 140), and a reply. L. S. T.

Origin of Chilean nitrate deposits. J. T. Singewald, jun. (*Econ. Geol.*, 1942, 37, 627—639).—A discussion. L. S. T.

Direction of flow of mineralising solutions. M. C. Bandy (*Econ. Geol.*, 1942, 37, 330—333; cf. A., 1942, I, 344). L. S. T.

Results of the Chilean mineralogical expedition of 1938. VI. Another hexahedrite (iron meteorite) from northern Chile. VII. Crystallography of alunogen, meta-alunogen, and pickeringite. Crystallography of fibroferrite. VIII. Crystallography of ferrinatrite. S. G. Gordon (*Nat. Naturæ*, 1942, No. 97, 101, 102, and 103, 3 pp., 4 pp., 2 pp., 9 pp.).—VI. The meteorite from Quillagua weighs 78 kg., ρ 7.699, and contains [P. Collins] Fe 93.53, Ni 5.48, Co 0.62, P 0.21, S 0.05, total 99.89%.

VII. Alunogen (I) from Francisco de Vergara has $a:b:c = 0.8355:1:0.6752$, $\alpha 89^\circ 58'$, $\beta 97^\circ 26'$, $\gamma 91^\circ 52'$. On exposure to air, (I) dehydrates readily to a white, monoclinic mineral, *meta-alunogen*. Pickeringite has $a:b:c = 0.8655:1:0.2551$, $\beta 96^\circ 33.5'$. Chemical analyses of all three minerals are recorded. Fibroferrite from the "Santa Elena" mine, La Alcaparrosa, Argentina, has $a:b:c = 0.5604:1:0.2162$.

VIII. Ferrinatrite, $\rho 2.562$, from the La Compania mine, the Quetena mine, and from Alcaparrosa has $\omega 1.557$, $\varepsilon 1.611$. The chemical analysis corresponds with $3\text{Na}_2\text{O}, \text{Fe}_2\text{O}_3, 6\text{SO}_3, 6\text{H}_2\text{O}$.

L. S. T.

Sand stalagmites. G. Baker (*J. Geol.*, 1942, 50, 662—667).—Stalagmites composed of shell and quartz sand, and having an origin similar to that of ordinary stalagmites, occur in a limestone cave of W. Victoria.

L. S. T.

Origin of the quartz deposit at Fazenda Pacú, Brazil. P. F. Kerr and A. I. Erichsen (*Amer. Min.*, 1942, 27, 487—499).—The quartz has resulted from vein-forming hypogene solutions of moderate temp.

L. S. T.

Spatial distribution of minor elements in single crystals. C. Frondel, W. H. Newhouse, and R. F. Jarrell (*Amer. Min.*, 1942, 27, 726—745).—The mechanism and geometrical consequences of crystal growth are outlined, and various types of compositional heterogeneity within single crystals are reviewed. Spectrographic analyses recorded for galena (I) and calcite (II) show that, in single crystals, the minor foreign elements are not uniformly dispersed throughout the host crystal, but are distributed in adjoining or alternating regions of greater or less concn., which are related to growth surfaces of the crystal. The concn. differences arise in the unequal adsorptive capacity of the different forms on the growing crystal for the foreign element. In (I), Ag and Si are relatively conc. in the octahedral face-loci; Cu, Fe, Al, Cr, Ba, Sr, Ca, and Mg show significant quant. variations, apparently unrelated to morphology. In (II), similar features of distribution occur, but morphology and colour of the crystals are not related to the minor elements Fe, Cu, Mn, Al, Sr, and Mg.

L. S. T.

Differentiation of the dolerites of Tasmania. I, II. A. B. Edwards (*J. Geol.*, 1942, 50, 451—480, 579—610).—The dolerites occur as sills of considerable extent, and at the time of its intrusion the dolerite magma was liquid and homogeneous in composition, being a saturated or tholeiitic basalt magma differing from typical tholeiites by being richer in SiO_2 , Al_2O_3 , and CaO , and poorer in FeO , TiO_2 , Na_2O , K_2O , and P_2O_5 . The chemical changes undergone by the dolerites are discussed, and numerous chemical analyses recorded.

L. S. T.

Geology and ore deposits of the Ashbrook silver mining district, Utah. V. E. Peterson (*Econ. Geol.*, 1942, 37, 466—502).—The ore occurs as irregular, patchy, replacement deposits in limestone the structure of which has markedly affected distribution of the ore bodies. The primary mineralisation can be divided into three periods of deposition: (i) rhodochrosite to the exclusion of other minerals, (ii) quartz, pyrite, arsenopyrite, sphalerite, and minor amounts of chalcopryrite, and (iii) galena, argyrodite, pyrargyrite, pearcite, tennantite, and an unidentified mineral. The second phase seems to be responsible for the minor Au vals. in the ores. Processes of enrichment and oxidation produced many secondary minerals. Alteration of the primary Ag minerals has been chiefly to argentite and native Ag.

L. S. T.

Paragenesis of some gold and copper ores of S.W. Oregon. W. R. Lowell (*Econ. Geol.*, 1942, 37, 557—595).—Cu ores in this locality are associated with greenstones and serpentines, whilst Au ores are associated with Tertiary lavas and nearly all of the pre-upper Cretaceous rocks. The ores consist of hypogene minerals deposited by mineralising solutions ascending along fractures, faults, and shear zones. Au and Cu minerals were deposited in the second of three stages of deposition. Unusual minerals include cassiterite, native Bi, and Te.

L. S. T.

Geology and paragenesis of the nickel ores of the Cuniptau mine, Goward Nipissing District, Ontario. B. T. Sandepur (*Econ. Geol.*, 1942, 37, 173—187).—Petrology and the mineralogy of the ores are described. Post-magmatic solutions deposited the Cu and Ni sulphides. The important and abundant Ni-bearing sulphide is the secondary mineral, violarite.

L. S. T.

Gold mineralisation in minor igneous intrusions. W. W. Moorhouse (*Econ. Geol.*, 1942, 37, 318—329).

L. S. T.

Distribution of indium in Transbaikal. N. M. Prosenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 907—908).—The geochemistry of the Transbaikal region is discussed with particular reference to the occurrence of In. In is usually conc. in polymetallic deposits, but is also present in many Sn and W deposits. Sphalerites are a frequent source of In, and minerals in the Au area of the region often contain it.

A. J. M.

Intrusive versus permissive vein emplacement. R. Farmin (*Econ. Geol.*, 1942, 37, 238—242).—A discussion (cf. Roberts, A., 1942, I, 347).

L. S. T.

Crystalline morphology of the scheelite group. J. D. H. Donnay (*Trans. Roy. Soc. Canada*, 1942, [iii], 36, IV, 37—57).—Application of morphological analysis to four iso-structural tetragonal species, viz., wulfenite, powellite, stolzite, and scheelite, shows that in spite of notable differences in faces, the unit face (111), the space-group, and the dimensions of the unit cell can, in each case, be satisfactorily determined. The data obtained agree with those given by X-ray methods.

L. S. T.

Granite and ore. A. L. Anderson (*Econ. Geol.*, 1942, 37, 510—519).—A discussion (cf. A., 1942, I, 348).

L. S. T.

Lineage structure and conditions of deposition of pyrite. F. G. Smith (*Econ. Geol.*, 1942, 37, 519—523; cf. A., 1942, I, 346).

L. S. T.

Banded haematite ores. J. A. Dunn (*Econ. Geol.*, 1942, 37, 426—430).—A criticism (cf. A., 1942, I, 346).

L. S. T.

Origin of some siderite, pyrite, chert deposits, Michipicoten district, Ontario. J. E. Hawley (*Trans. Roy. Soc. Canada*, 1942, [iii], 36, IV, 79—86).—Theories of origin, and age relations of the siderite, pyrite, and chert, and time of replacement are discussed.

L. S. T.

Crystal structure of cordierite.—See A., 1943, I, 117.

Isomorphism and isotypism among silicates and phosphates. D. McConnell (*Science*, 1943, 97, 98—99).—A short discussion of recent developments in the mineral groups, the garnets and the apatites.

E. R. R.

Geochemical study of blends. J. M. López de Azcona (*Separate, Madrid*, 1942, 15 pp.).—In 133 samples of blende, largely from Spanish sources, 30 elements were identified spectrochemically, of which those in the periodic groups Ib, IIb, IIIb, IVb, and Vb predominated. Sb, Co, and In occur only in presence of Pb, Fe, and Sn respectively. Approx. determination of galena, blende, and pyrites in mixtures of these is possible by comparison of their spectrograms with those of artificial mixtures.

F. R. G.

Magnetisation of rocks. E. F. Herroun and A. F. Hallimond (*Proc. Physical Soc.*, 1943, 55, 214—221).—Specimens of natural rock collected in Great Britain were tested for susceptibility and permanent magnetisation before and after various artificial treatments. After cooling in the earth's field, cut cubes had a higher magnetic intensity than the natural rock, and decay with time was slight. When artificially magnetised in the cold, the cubes were affected only by fields above a certain val., and decay was often considerable. Curves showing decay with time and demagnetisation of the heated cubes by increasing fields are given. The susceptibility of natural rocks increases with the field, in some cases reaching a max. at 50—100 c.g.s.

N. M. B.

Boulangerite. C. Palache and H. Berman (*Amer. Min.*, 1942, 27, 552—562).—Boulangerite (I) is monoclinic, prismatic, pseudo-orthorhombic, and shows ~60 crystal forms; $a:b:c = 0.9158:1:0.3456$, $\beta 100^\circ 39\frac{1}{2}'$, $a_0 21.14$, $b_0 23.46$, $c_0 8.07$ A., $\beta 100^\circ 48'$, $\rho_{\text{obs.}} 5.98 \pm 0.02$. Chemical analyses [F. A. Gonyer] on Washington (I) confirm the cell content of $\text{Pb}_{40}\text{Sb}_{32}\text{S}_{88}$.

L. S. T.

Inesite. W. E. Richmond (*Amer. Min.*, 1942, 27, 563—569; cf. A., 1939, I, 286).—The new orientation with $a:b:c = 0.9700:1:1.3208$, $\alpha 87^\circ 42'$, $\beta 132^\circ 35\frac{1}{2}'$, $\gamma 97^\circ 01'$, chosen for inesite (I) retains the similarity (I) shows to members of the wollastonite group. X-Ray measurements on a cleavage fragment gave $a_0 8.89$, $b_0 9.14$, $c_0 12.14$ A., $a_0:b_0:c_0 = 0.973:1:1.328$, $\alpha 87^\circ 38\frac{1}{2}'$, $\beta 132^\circ 30'$, $\gamma 97^\circ 05\frac{1}{2}'$; $\rho_{\text{obs.}}$ is 3.03. The calc. cell formula is $\text{Mn}_7\text{Ca}_2\text{Si}_{10}\text{O}_{28}(\text{OH})_2 \cdot 5\text{H}_2\text{O}$. (I) is closely related to a high-Ca rhodonite, which can be regarded as a dehydrated (I).

L. S. T.

Mineralogy of metamorphosed serpentine at Humphreys, Fresno Co., California. A. Pabst (*Amer. Min.*, 1942, 27, 570—585).—A re-examination and re-interpretation of previous work (Macdonald, A., 1941, I, 491).

L. S. T.

Occurrence of ilsemanite. E. D. Goldring (*Amer. Min.*, 1942, 27, 717—719).—Ilsemanite, $\text{MoO}_3 \cdot \text{SO}_3 \cdot 5\text{H}_2\text{O}$, and its associates occurring at a fluorspar mine in Jackson Co., Colorado, are described.

L. S. T.

Re-examination of hibsichte. A. Pabst (*Amer. Min.*, 1942, 27, 783—792).—X-Ray powder patterns of hibsichte (I) from the type locality at Aussig, Bohemia, closely resemble those of grossularite and plazolite (II). This confirms the view (A., 1940, I, 45) that (I) is nearly identical with (II).

L. S. T.

Ludwigite from Colorado Gulch, near Helena, Montana. A. Knopf (*Amer. Min.*, 1942, 27, 824—825).—An abundant occurrence of the relatively rare Mg Fe borate, $\rho 3.70 \pm 0.02$, is described.

L. S. T.

Leached derivatives of arsenopyrite and chromite. R. Blanchard (*Econ. Geol.*, 1942, **37**, 596—626).—Arsenopyrite (I) and chromite (II) are unusual genetic associates, but their leached derivatives possess a common characteristic; the arborescent pattern or structure of their limonitic pseudomorphs is bolder in relief and more uniformly persistent than obtains in limonitic derivatives of other sulphides or ore minerals. The pseudomorphs are described and illustrated, and data showing the chemical and mineralogical changes that take place during oxidation and leaching of (I) and (II) are recorded. L. S. T.

Concepts on the geology of quicksilver deposits in the United States. C. P. Ross (*Econ. Geol.*, 1942, **37**, 439—465).—Hg deposits of the type mined in the U.S. are formed at geologically shallow depths and relatively low temp. and pressures. Dil. hydrothermal solutions of relatively simple composition are modified by mingling with ground H₂O before pptn. occurs, and hence the gangue of the deposit varies in composition with local environment. Few other metals are associated with cinnabar (I) deposits, which tend to be remote from those of other metals. This suggests that (I) lodes may be end-products formed after other constituents in the hydrothermal solutions from the magmatic source had been pptd. (I) ore is confined to parts of rocks where the solutions found easy access, and tends to be conc. where suitable traps existed. Pptn. of (I) is produced by any charges that lower temp. and decrease alkalinity. Supergene changes have occurred in some (I) lodes, but not on a scale large enough to be economically significant. L. S. T.

Unusual olivine in basalt near Auckland, New Zealand. J. A. Bartrum (*J. Geol.*, 1942, **50**, 914—917).—An olivine, characterised by an unusual separation of Fe ore, is described. L. S. T.

Age relationships of intrusive rocks and ore deposits in the Red Lake Area, Ontario. H. C. Horwood and N. B. Keevil (*J. Geol.*, 1943, **51**, 17—32).—Chemical analyses and He radioactivity data for rocks are recorded. Data obtained from field geology, microscopical examination of mineral concentrates, and He age determinations have been combined for the first time to determine the relationship between different intrusive formations and between igneous rocks and ore deposits. L. S. T.

Manganese-bearing veins in S.W. Virginia. A. I. Jonas (*Econ. Geol.*, 1942, **37**, 408—423).—Spessartite veins occurring in the cryst. schists and gneisses of Carroll and Grayson Counties, Virginia, are discussed. L. S. T.

Exsolution in ore minerals. G. M. Schwartz (*Econ. Geol.*, 1942, **37**, 345—364).—Evidence that 50 pairs of minerals show textures that suggest the occurrence of exsolution during their formation is summarised. Criteria suggested previously (*ibid.*, 1931, **26**, 739) are revised and amplified. L. S. T.

Rare alkalis in micas. R. E. Stevens and W. T. Schaller (*Amer. Min.*, 1942, **27**, 525—537).—Determinations of all the alkalis in 43 samples of mica, including paragonite, muscovite, biotite, phlogopite, vermiculite, zinnwaldite, taeniolite, lepidolite, and polyolithionite, are recorded. The geological occurrences of Li, Rb, and Cs are discussed. Li, Rb, and Cs in micas increase from successive stages of hydrothermal replacement in pegmatites. Li was found in all the micas, but Rb and Cs were found only in micas from the later stages of magmatic differentiation. Distribution of these three alkalis in any mica or pegmatite is erratic. L. S. T.

System albite-anorthite-sphene. A. T. Prince (*J. Geol.*, 1943, **51**, 1—16).—The phase-equilibrium relationships at 1 atm. and high temp. in the systems albite (I)-sphene (II), anorthite (III)-(II), and (I)-(II)-(III) have been investigated by the quenching method. Data for the limiting runs in each system are presented. Equilibrium diagrams are given, and the courses of crystallisation of typical mixtures under conditions of equilibrium and perfect fractionation described. The petrological significance of the results is discussed by means of a tentative quaternary diagram of the system (I)-(III)-diopside-(II). L. S. T.

Crystallographic notes. Cristobalite, stephanite, and natrolite. J. Murdoch (*Amer. Min.*, 1942, **27**, 500—506).—Cristobalite crystals with cubic habit occur at Two Rivers, California. Doubly-terminated crystals of stephanite show pronounced diversity in the forms on opposite ends of crystals, which confirms the hemimorphic character of the mineral. Natrolite crystals in which the square prismatic habit is due to the *a* and *b* pinacoids rather than the prism are described. L. S. T.

Occurrence of pink zoisite (thulite) in the United States. W. T. Schaller and (Miss) J. J. Glass (*Amer. Min.*, 1942, **27**, 519—524).—Occurrences from 12 states are recorded. Average vals. for *n* are α 1.695, β 1.698, and γ 1.706. L. S. T.

Sampleite, a new mineral from Chuquicamata, Chile. C. S. Hurlbut, jun. (*Amer. Min.*, 1942, **27**, 586—589).—Sampleite is orthorhombic, dipyramidal, with *a*₀ 9.70, *b*₀ 38.40, *c*₀ 9.65 Å., hardness 5, $\rho_{\text{obs.}}$ 3.20, *M*₀ 6971, unit cell 8[NaCaCu₅(PO₄)₄Cl₅H₂O]. Chemical analyses are recorded. L. S. T.

Identity of ascharite, camsellite, and β -ascharite with szaibelyite; and some relations of the magnesium borate minerals. W. T. Schaller (*Amer. Min.*, 1942, **27**, 467—486).—Published vals. for *n* of ascharite are incorrect. Corr. vals., new chemical analyses, and X-ray powder photographs show that szaibelyite (I), ascharite, camsellite, and β -ascharite are identical; only the first name is to be retained. Optical and physical properties and chemical analyses of the (I)-sussexite series and the fluoroborate series are tabulated and discussed. Vals. of *n* for the Mg borate minerals are recorded. L. S. T.

X-Ray study of monetites and related compounds.—See A., 1943, I, 143.

Differential thermal analysis of clay minerals and other hydrous minerals. I, II. R. E. Grim and R. A. Rowland (*Amer. Min.*, 1942, **27**, 746—761, 801—818).—Differential thermal curves for numerous clay minerals and related silicates, and for natural and artificial mixtures of clay minerals, are reproduced. The characteristics of the curves for illites (I), kaolinites, montmorillonites (II), and other clay minerals are discussed. The significance of the data with regard to the lattice structure of the minerals and to the charges undergone on heating is also discussed. The use of differential thermal curves for identifying clay minerals and estimating relative abundance in conjunction with X-ray, optical, and chemical methods is critically analysed. Thermal evidence indicates that many bentonites and other clays supposed to consist of single clay minerals are mixtures of minerals closely intergrown. Certain clay mineral names are open to doubt. Chemical analyses of (II), and clays containing (II), so-called beidellite, (I), and bravaisite, are recorded. L. S. T.

Mixed cation effects in the estimation of base-exchange capacities of hydrogen-clays. J. N. Mukherjee, R. P. Mitra, and K. C. Ghosh (*J. Indian Chem. Soc.*, 1942, **19**, 397—398).—The effect of adding to a H-clay a salt having cations other than those of the base used for titration has been investigated. Vals. for the base-exchange capacity (*B*) of a clay with a given base and with a fixed concn. of different salts decreased in the order BaCl₂ > CaCl₂ > NaCl. For different bases and a fixed salt the order is Ba(OH)₂ > Ca(OH)₂ > NaOH. In presence of BaCl₂ or CaCl₂, NaOH gives a smaller *B* than Ba(OH)₂ or Ca(OH)₂, indicating some sort of ionic antagonism between the comparatively few Na⁺ on the one hand and the large no. of Ba⁺⁺ or Ca⁺⁺ on the other. C. R. H.

Effect of non-electrolytes on the pH and specific conductivity of hydrogen-clay sols. R. P. Mitra and K. C. Ghosh (*J. Indian Chem. Soc.*, 1942, **19**, 399—400).—If EtOH is added to a H-clay soil there is a sharp rise in sp. conductivity (*c*) and a sharp fall in pH. As [EtOH] increases *c* reaches a max. and falls rapidly to a const. val. Similarly pH decreases to a min. and rises to a const. val., max. *c* and min. pH vals. occurring at approx. the same [EtOH]. *c* tends to increase and pH to decrease with time. C. R. H.

Free and titratable acids per particle of subfractions of hydrogen-clay. R. P. Mitra and S. P. Ray (*J. Indian Chem. Soc.*, 1942, **19**, 401—402).—Free and titratable acids of 0.25% suspensions of subfractions of H-clays have been calc. from e.m.f. and potentiometric titration data. The no. of free and titratable H⁺ associated with the largest particles is ~10⁶ and 10⁸ respectively, the no. being less for smaller particles. C. R. H.

Limiting exchange of aluminium ions from hydrogen-clays on the addition of neutral salts. J. N. Mukherjee, B. Chatterjee, and P. C. Goswami (*J. Indian Chem. Soc.*, 1942, **19**, 405—407).—The amounts of Al displaced from a H-clay sol after successive leachings with N-BaCl₂ and -CaCl₂ and the total acidity decreased with the progress of leaching. Ba⁺⁺ displaced slightly more Al⁺⁺⁺ and H⁺ than Ca⁺⁺. C. R. H.

Titanium in the principal zonal soils of the European part of the U.S.S.R. S. E. Kaminskaja (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **33**, 50—53).—Analysis of 15 zonal soils from the European part of the U.S.S.R. shows a considerable degree of uniformity in the Ti content, which varies from 0.24 to 0.79% of the soil after drying. Ti has low mobility in the geochemical sense. A. J. M.

Occurrence of millerite in the Durham coal measures. W. Anderson and J. A. Smythe (*Geol. Mag.*, 1942, **79**, 220—224).—Occurrence of secondary millerite in sandstone cemented with ankerite is described. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JULY, 1943.

I.—SUB-ATOMICS.

Atomic spectra of rare earth elements. W. F. Meggers (*Rev. Mod. Physics*, 1942, 14, 96—103).—The ground states and ionisation potentials of rare earth elements, as known at present, are collected and discussed, and lines of future investigation are indicated. A. J. M.

Absorption spectra of potassium, rubidium, and caesium. H. R. Kratz and J. E. Mack (*Rev. Mod. Physics*, 1942, 14, 104).—The long optical path needed to reduce resonance broadening was obtained by repeated traversal between a concave spherical mirror at one end of an Fe tube and a totally-reflecting prism at the other. It was possible to resolve the principal series doublets to the 14th member for K, the 22nd for Rb, and the 15th for Cs. Unresolved higher members were recorded to the 76th member for K, the 73rd for Rb, and the 66th for Cs. The doublet separations agree with the inverse cube law. It was not possible to deduce a Ritz formula to cover the principal series of K. A. J. M.

Direct determination of the charge of the β -particle. Y. Beers (*Physical Rev.*, 1943, [ii], 63, 77—85; cf. A., 1941, I, 22).—The charge of Ra-E β -particles was determined by measuring the charge carried per sec. by a magnetically analysed beam and then, after the beam had been reduced by a known fraction by the decay of the source, by counting the no. of particles per sec. in the beam. The average val. obtained was $-4.80 \pm 0.03 \times 10^{-10}$ e.s.u., in agreement with the accepted val. The observed half-life of Ra-E was 4.99 days. No dependence of charge or half-life on H_0 was detected. N. M. B.

Simple method of investigating secondary electrons excited by γ -rays and the interference of these electrons with measurements of primary β -ray spectra. L. Meitner (*Physical Rev.*, 1943, [ii], 63, 73—76, 384).—The special directional distribution of the Compton electrons can be used to obtain their absorption curve and upper energy limit without coincidence measurements, and this must be taken into account in studying primary β -spectra by absorption measurements. The complexity of the primary β -ray spectrum of ^{59}Fe (cf. Livingood, A., 1938, I, 427) is apparently due to the interference of secondary electrons. N. M. B.

Positive and negative point-to-plane corona in pure and impure hydrogen, nitrogen, and argon. G. L. Weissler (*Physical Rev.*, 1943, [ii], 63, 96—107).—In accordance with theory, no pre-onset streamers or burst pulses were observed in pure H_2 and N_2 . At high fields weak streamers developed which ultimately led to breakdown. Adding traces of O_2 to H_2 or N_2 at once produced weak pre-onset streamers, and at higher concns. produced burst pulses. Trichel pulses are not observed in pure H_2 and N_2 , but are at once produced on addition of traces of O_2 ; potentials for negative corona are $<$ for positive corona. For A, with positive point potential, the first streamer formed caused spark breakdown, and with negative point potential a heavy arc replaced the corona. Contamination of the A with H_2 or N_2 introduced streamers for the positive corona, similar to those in air, an effect attributed to the suppression of metastable atoms in A by the impurity. For the negative corona, 0.1—0.5% of H_2 or N_2 prevented arcing and yielded a strong corona with glow discharge characteristics but no Trichel pulses. Addition of sufficient O_2 causes A to act in all respects like air except that the onset potentials were \ll in air. A clean-up of impurities in the negative corona in H_2 is due to formation and absorption of H_2O vapour. N. M. B.

Theory of the magnetron. III. L. Brillouin (*Physical Rev.*, 1943, [ii], 63, 127—136; cf. A., 1942, I, 381).—Mathematical. N. M. B.

Theory of α -ray counting from solid sources. N. B. Keevil and W. E. Grasham (*Canad. J. Res.*, 1943, 21, A, 21—36).—Theory for thin sources of at. dimensions, for layers of equiv. thickness $<$ the range of the particle, and for thick sources is developed. For α -ray counting from rocks which normally contain 25 α -ray emitters, resultant equations and curves are given which can be used directly in computing actual emission from observed count. A test of the theory by experimental results on granite is given. N. M. B.

Search for element no. 87. F. R. Hirsh, jun. (*Physical Rev.*, 1943, [ii], 63, 93—95; cf. A., 1937, I, 274).—With fluorescent

CsHSO_4 from lepidolite (I) in which free Tl has been found, there was no trace of the $\text{La}_{1,2}$ X-ray lines of element 87 in fluorescence spectra. There is evidence that the free Tl is derived from unstable element 87 atoms which had been present in the (I) mol. N. M. B.

Inelastic scattering of protons. R. H. Dicke and J. Marshall, jun. (*Physical Rev.*, 1943, [ii], 63, 86—90).—Protons scattered at 135° by a thin foil are detected by a proportional counter feeding a scaling circuit biased to count only the large pulses resulting from slowly moving protons. Al stopping foils slow down the scattered protons so that protons of a particular energy group move through the counter slowly and are counted. The no. of these plotted against thickness of stopping foil gives a curve in which peaks represent different proton energy groups. Well-defined peaks corresponding with inelastically scattered protons are illustrated with curves and data for Al, Cr, Mg, and S, and excitation energies are computed. N. M. B.

Radioactive isotopes of lanthanum. (Miss) K. E. Weimer, M. L. Pool, and J. D. Kurbatov (*Physical Rev.*, 1943, [ii], 63, 67—72).— ^{140}La , previously produced by deuteron and slow-neutron bombardment of La, has been produced by the reaction $^{140}\text{Ce}(n, p)^{140}\text{La}$; the half-life is 40.0 ± 0.3 hr. There is evidence of the reaction $^{138}\text{Ba}(d, \gamma)^{140}\text{La}$. ^{140}La decays with emission of 1.41 ± 0.05 -Me.v. electrons and 2.00 ± 0.05 -Me.v. γ -rays. Deuteron or proton bombardment of Ba produces a new activity of half-life 17.5 ± 0.5 hr., assigned to ^{137}La , and decaying by K-electron capture with emission of X-rays identified as characteristic K-radiation of Ba. The presence of a low-intensity 0.88 ± 0.1 -Me.v. γ -ray indicates that the resulting Ba nucleus may be left in an excited state. N. M. B.

γ -Rays from ^{76}As . C. E. Mandeville (*Physical Rev.*, 1943, [ii], 63, 91—93).—The recoil electron spectrum of the γ -rays from ^{76}As , examined in a magnetic spectrograph (cf. A., 1943, I, 47), is composed of two electron groups corresponding with energies 0.83 ± 0.02 and 1.94 ± 0.04 Me.v., and intensity ratio 3.8:1. Results suggest excitation levels at 0.8 and 2.8 Me.v. in the ^{76}Se residual nucleus. N. M. B.

Specific primary ionisation of cosmic rays in helium. W. E. Hazen (*Physical Rev.*, 1943, [ii], 63, 107—110).—A magnetic field allowed separation of 46 cosmic-ray tracks in cloud-chamber photographs into a group of 21 electrons with energies near the min. ionisation energy and with a mean ionisation of 7.33 ± 0.12 per cm., and 25 mesotrons with energies $>$ the min. ionisation energy and with 7.23 ± 0.12 per cm. mean ionisation, compared with the expected val. 8.80 ions per cm., taking into account a logarithmic rise of ionisation with energy. The experimental min. sp. primary ionisation in He (corr. for ionisation in the vapour) is 6.5 ± 0.1 at n.t.p. N. M. B.

Thermal equilibrium between elementary particles. G. Wataghin (*Physical Rev.*, 1943, [ii], 63, 137).—Mathematical considerations, in extension of an earlier study (cf. A., 1934, 712), arising from recent papers on the prestellar stage of the universe. N. M. B.

Physical theory of comets in the light of spectroscopic data. N. T. Bobrovnikoff (*Rev. Mod. Physics*, 1942, 14, 164—178).—The problems raised by new spectroscopic data concerning comets are discussed. An extensive bibliography is given. A. J. M.

II.—MOLECULAR STRUCTURE.

Emission spectrum of the ion CO_2^+ . S. Mrozowski (*Rev. Mod. Physics*, 1942, 14, 216—218).—The emission spectrum of CO_2^+ and its analysis are discussed. A selection rule of unknown nature appears to operate. A. J. M.

Molecular bands in cometary spectra. Identifications. P. Swings (*Rev. Mod. Physics*, 1942, 14, 190—194).—Bands due to OH, NH, CN, CH, C_2 , CH^+ , CO^+ , and N_2^+ have been identified in cometary spectra. Identification is hampered by the peculiar intensity distributions found. Work on the identification of the λ 4050 Å. group of strong lines is reviewed, the most satisfactory conclusion being that it is due to CH_2 . A. J. M.

Intensity measurements on emission bands in cometary spectra. A. McKellar (*Rev. Mod. Physics*, 1942, 14, 179—189).—The excit-

ation of cometary bands is discussed, with particular reference to the excitation of CN, CH, and C₂ in the cometary nucleus and head. Intensity measurements on bands in the spectra of comets 1939d and 1940c are given. There is considerable evidence that the CN bands are produced by the absorption and subsequent re-emission of solar radiation of their own λ . The brightness and form of the CN bands are related to the radial velocity of the comet with respect to the sun. The intensity distributions differ considerably from smooth, low-temp. distributions of the Boltzmann type. A. J. M.

Evidence for the presence of CH₂ molecules in comets. G. Herzberg (*Rev. Mod. Physics*, 1942, **14**, 195—197).—The structure of the λ 4050 Å. group of strong lines in cometary spectra agrees most satisfactorily with its assignment to CH₂. Such a group can be produced in the laboratory in a discharge through rapidly streaming CH₄. A. J. M.

***l*-Type doubling in linear polyatomic molecules.** G. Herzberg (*Rev. Mod. Physics*, 1942, **14**, 219—223).—The infra-red spectra of C₂H₂, HCN, and CO₂ give evidence of a splitting of the Π vibrational levels into two components, which is called *l*-type doubling. The evidence is summarised for C₂H₂, and further evidence is added for HCN and CO₂. The existence of the *l*-type doubling explains the fact that the fundamental bands of HCN and C₂H₂ do not show a convergence of the *P* and *R* branches, whilst the *Q* branch is distinctly shaded to shorter $\lambda\lambda$. A preliminary theoretical discussion is given. The rotational consts. of CO₂ have been re-evaluated, *l*-type doubling being taken into account. The moment of inertia, $I_e = 71.67 \times 10^{-40}$ g.-cm.², and the C—O distance $r_e = 1.1615$ Å. A. J. M.

***l*-Type doubling in linear polyatomic molecules.** H. H. Nielsen and W. H. Shaffer (*J. Chem. Physics*, 1943, **11**, 140—144).—Mathematical. Certain Coriolis interaction terms in the rotation-vibration Hamiltonian of a linear polyat. mol. give second-order contributions to the energy which remove degeneracy of *l*-levels of internal angular momentum arising from a doubly degenerate perpendicular mode of oscillation. This is called "*l*-doubling," and exists for all states having a quantum no. $l_k \neq 0$. It is likely that only in Π vibration states is the effect large enough to be of importance in spectral interpretation. The *l*-type splitting must also occur in perpendicular states of axially symmetrical mols. A. J. M.

Vibrational frequencies of isotopic water molecules; equilibria with the isotopic hydrogens. W. F. Libby (*J. Chem. Physics*, 1943, **11**, 101—109).—The fundamental frequencies, anharmonicities, and vibrational modes for the mols. HDO, HTO, DTO, and T₂O are calc. on the basis of the analysis of the vibrational spectrum of H₂O made by Dennison and Darling (A., 1940, I, 146). The isotopic equilibria between "water" and "H₂" mols. are examined and the equilibrium consts. for nine reactions between H₂O, D₂O, T₂O, HD, HT, and DT are evaluated. Experimental vals. for the reactions $\text{HD} + \text{H}_2\text{O} = \text{H}_2 + \text{HDO}$ and $\text{HT} + \text{H}_2\text{O} = \text{H}_2 + \text{HTO}$ are compared with the calc. vals. The results indicate the validity of the assumption that the vibrational potential function of a mol. is independent of the isotopic composition of its constituent elements. A. J. M.

Absorption of infra-red radiation by water vapour and carbon dioxide. M. McCaig (*Phil. Mag.*, 1943, [vii], **34**, 321—342).—The absorption of black-body radiation by H₂O vapour, CO₂, and mixtures of these gases with each other and with N₂ has been measured over a total pressure (*P*) range of 0.1—2 atm. and a path-length of 25—100 cm. Beer's law holds for CO₂-N₂, and H₂O-N₂ mixtures if *P* is const. If *P* is increased, absorption increases. Beer's law does not hold for H₂O vapour, even when *P* is kept const., increase of partial pressure resulting in increased absorption. The effect of change of temp. and of source of radiation on the absorption has been investigated. Theoretical reasons for departures from Beer's law are discussed. A. J. M.

Electronic structures and spectra of triatomic oxide molecules. R. S. Mulliken (*Rev. Mod. Physics*, 1942, **14**, 204—215).—The existing knowledge of the forms and electronic spectra of SO₂, ClO₂, NO₂, O₃, CO₂, and CS₂ is reviewed. New conclusions regarding the electronic structure of O₃ are reached. A diagram showing ionisation energy of the various normal and excited valency shell mol. orbitals as a function of the apex angle is given, and it is shown that this, or a similar diagram, is of considerable use in explaining electronic structures and spectra of the mols. concerned. The form of the mol. orbitals of CO₂ is reviewed, and some modifications are suggested. A. J. M.

Absorption spectra of solids. R. C. Waller (*Iowa State Coll. J. Sci.*, 1942, **17**, 149—151).—The absorption spectrum of Pr₂O₃ contained in various crystal forms of La₂O₃ and Eu₂O₃ has been measured at 78° and 300° K. Two energy levels differing by 99 cm.⁻¹ at 78° K. and 108 cm.⁻¹ at 300° K. have been identified. The spectrum includes a red multiplet at 6000 Å., corresponding to the transition $^3H_4 \rightarrow ^1I_6$, and three strong multiplets in the blue region corresponding to the transitions from 3H_4 to 3P_0 , 3P_1 , and 3P_2 . J. W. S.

Absorption spectra of some neodymium compounds. J. F. Palmer, jun. (*Iowa State Coll. J. Sci.*, 1942, **17**, 106—107).—The absorption

spectra of solid Nd(BrO₃)₃·9H₂O and α -Nd₂O₃ have been measured over the λ range 3800—8500 Å. and at 80°, 170°, 200°, and 300° K. Const. ν differences, which vary with temp. according to the Boltzmann relation, are 116 and 380 cm.⁻¹ for Nd(BrO₃)₃·9H₂O and 245 cm.⁻¹ for Nd₂O₃. The theoretical curve relating magnetic susceptibility with temp., deduced from these data, follows the observed vals. to fairly high temp. J. W. S.

Structure and ultra-violet spectra of ethylene, butadiene, and their alkyl derivatives. R. S. Mulliken (*Rev. Mod. Physics*, 1942, **14**, 265—274).—A review of work on the absorption spectra of C₂H₄, butadiene (I), and their alkyl derivatives in the neighbourhood of 2000 Å. is given. Quantum-mechanical calculations on electronic term vals. and red shifts due to hyperconjugation with alkyl groups are given, and it is concluded that decreases in ionisation potential on alkyl substitution are due chiefly to charge transfer, but that red shifts are due partly to this and partly to hyperconjugation. Spectroscopic and refractivity data indicate that the *sym-trans*-form is the stable form of (I) and its open-chain derivatives. The stability of the planar arrangement in the *N*, *V*, and *R* electronic states of the mol. and its positive ion is discussed. The planar form is not very stable in the ion. A. J. M.

Absorption spectra of a series of dienes. E. P. Carr, L. W. Pickett, and H. Stücklen (*Rev. Mod. Physics*, 1942, **14**, 260—264).—The absorption spectra of 18 mono-olefines and 2 cyclic hydrocarbons with one double bond are reviewed. In every case there is low-intensity absorption in the neighbourhood of 40,000 cm.⁻¹, followed by intense and very characteristic absorption above 43,000 cm.⁻¹. The absorption spectra of 11 aliphatic dienes and 3 cyclic dienes have been examined. They differ considerably according to whether the double bonds are isolated, conjugated, or adjacent. The effect of substitution of Me is discussed, and the displacement of corresponding bands with respect to those of butadiene is obtained and discussed. A. J. M.

Ultra-violet absorption spectra of nitrogenous heterocycles. Blocking effect of methyl groups on the ultra-violet absorption spectra of hydroxypurines and pyrimidines.—See A., 1943, II, 208.

Photoluminescence and association of ions in lead salt solutions. B. E. Gordon (*J. Phys. Chem. Russ.*, 1941, **15**, 448—458).—Ultra-violet illumination of PbCl₂ solutions produces a green luminescence, the intensity (*I*) of which increases with [PbCl₂]; when KCl is added to a Pb(ClO₄)₂ solution, *I* has a max. at *m*-KCl. The λ range of the luminescence is shifted towards blue when [PbCl₂] and [KCl] are increased. The [Cl⁻] of these solutions is determined potentiometrically, and it is concluded that the luminescence is due to PbCl⁺ and varies with the thickness of the ionic atm. Solutions of K₂PbO₂ show a yellow luminescence. J. J. B.

Raman spectra of sugars. R. F. Stamm (*Iowa State Coll. J. Sci.*, 1942, **17**, 136—137).—The Raman spectra of solid α - and β -D-glucose, equilibrium aq. solutions of D-glucose (5, 15, and 50 mols. of H₂O per mol. of glucose), solid β -D-mannose, and sucrose have been measured, the Hg 2537 Å. line being used for excitation. α -D-Glucose, sucrose, and β -D-mannose show a sharp frequency at 850 cm.⁻¹ which is attributed to the breathing frequency of the pyranose ring. It is concluded that the vibration frequencies could be used for qual., and possibly quant., analysis of simple mixtures of sugars. J. W. S.

Ionisation and dissociation by electron impact: methyl and ethyl radicals. J. A. Hipple and D. P. Stevenson (*Physical Rev.*, 1943, [ii], **63**, 121—126).—PbMe₄ and PbEt₄ were decomposed to yield free Me and Et radicals in a special furnace built into the ionisation chamber of a 180° mass-spectrometer tube. From the initial breaks in the ionisation efficiency curves of Me⁺ and Et⁺ ions, the vertical ionisation potentials of the respective radicals are 10.0₀ ± 0.1 and 8.6₀ ± 0.1 e.v., in good agreement with vals. calc. indirectly from other electron impact data on hydrocarbons. N. M. B.

Dipole moments and intermolecular association of polyhydric alcohols. Y. L. Wang (*Z. physikal. Chem.*, 1940, **B**, **45**, 323—328).—The following vals. (in D.) are given: H₂O 1.91; (CH₂-OH)₂ 2.18, OH·[CH₂]₄·OH 2.40, OH·[CH₂]₁₀·OH 2.36, glycerol 2.67, OH·[CH₂]₂·CH(CH₂-OH)₂ 2.76 (in dioxan); EtSH 1.38 (in C₆H₆). W. R. A.

Stereochemistry of labile compounds. W. H. Mills (*J.C.S.*, 1943, 194—199).—The difficulties of demonstrating the optical activity of asymmetric N^{III} compounds and the possibilities of surmounting them are discussed. Substituting groups of varying size or of different polarities will not have the desired effect of increasing to any great extent the stability of the N valency system of NH₃. The salts of the amidines and substituted amides, which exhibit torsional rigidity, are considered suitable for investigating mol. dissymmetry, although the difficulties of preparing an optically active amidine salt are probably great. Methods of resolution are also discussed. C. R. H.

Tautomerism of benzoquinone-*p*-nitrosophenol systems. 3-Fluoro-4-nitrosophenol.—See A., 1943, II, 159.

Structure of boron hydrides. J. K. Sirkin and M. E. Diatkina (*J. Phys. Chem. Russ.*, 1941, 15, 459—469).— B_2H_4 has the structure $BH_2^+ \cdot BH_2^-$; the other B hydrides are also compounds of cations and anions containing B and H. The theory explains the non-existence of B hydrides with an odd no. of electrons. J. J. B.

Parachors and radii. K. H. Sun and A. Silverman (*J. Physical Chem.*, 1943, 47, 50—59).—New ionic parachor factors (ϕ) are assigned to a no. of elements and groups. The following relation has been derived theoretically and applies to ionic linkings at 1000°: $\phi = kr^c$, where $k = 28$, r = ionic radius in Å., and $c = 2.25$. The same relation has been derived empirically for covalent linkings, in which case r = covalent radius, $k = 12\pi - 28$, and $c = (10 - n)/2$, where n = group no. of the element. Calc. parachors for Na_2O-SiO_2 glasses at 1000° agree with published data. C. R. H.

Physical representation of mechanisms of energy transfer in the zone of interaction [between radiation and molecules] in biological processes initiated by radiation. See A., 1943, III, 425.

III.—CRYSTAL STRUCTURE.

Method for the summation of the Fourier series used in the X-ray analysis of crystal structures. A. L. Patterson and G. Tunell (*Amer. Min.*, 1942, 27, 655—679).—A method for the summation of one-dimensional Fourier series is detailed, and a procedure that enables this method to be applied to the summation of two-dimensional series, such as those by which the electron density of a crystal is represented as a function of the co-ordinates in the projection of the unit on a particular plane, is described. The method is suitable for the range of F -vals. (or of $|F|^2$ -vals.) from 0 to 1000. L. S. T.

Gnomonic projection in the hexagonal system. L. S. Ramsdell (*Amer. Min.*, 1942, 27, 819—823).—The continued use of the G_z setting, either for hexagonal or rhombohedral crystals, is unnecessary. L. S. T.

Basic principles involved in the glassy state. B. E. Warren (*J. Appl. Physics*, 1942, 13, 602—610).—Materials used in making glasses may be divided into network-formers, e.g., SiO_2 , B_2O_3 , P_2O_5 , and modifiers, e.g., Na_2O , K_2O , CaO , MgO , PbO . The at. arrangement in glass in general and the structure of the silicate glasses are discussed. The effects of disorder in vitreous SiO_2 compared with the ordered arrangement in the cryst. form are indicated. The factors determining immiscibility in the $CaO-SiO_2$ system are considered from the point of view of free energy and the no. of ions available at various concns. for the formation of bonds. The expansion of B_2O_3 glasses and the effect of introduction of SiO_2 and Na_2O into these glasses are discussed. A. J. M.

Crystal structure of gadolinium formate, $(HCO_2)_3Gd$. A. Pabst (*J. Chem. Physics*, 1943, 11, 145—149).—Laue, rotation, and powder methods have been used. The lattice is rhombohedral, $a_0 = 6.17$ Å., $\alpha = 115^\circ 30'$; unit cell contains 1 mol.; ρ_{calc} 3.85, ρ_{obs} 3.77. The space-group is probably C_{3h}^2-R3m . The radius of the Gd^{+++} ion in $(HCO_2)_3Gd$ is 0.98 Å., in agreement with other determinations. A. J. M.

Configuration of starch and its crystalline degradation products. D. French (*Iowa State Coll. J. Sci.*, 1942, 17, 60—62).—Maltose hydrate is monoclinic, lattice a_0 4.9, b_0 15.2, c_0 10.7 Å., β 82.5°, space-group $C_2^2-P2_1$. The unit cell contains 2 mols. and the packing dimensions are 4.9, 7.6, and 10.7 Å. For the Schardinger α - and β -dextrins the vals. are a_0 15.49, b_0 24.06, c_0 13.93 Å., space-group I^4 , 4 mols. per cell of 24.03 glucose residues, and a_0 15.27, b_0 10.24, c_0 20.93 Å., β 68.0°, space-group C_2^2 , 2 mols. per cell of 14.05 glucose residues, respectively; these compounds are therefore cyclohexa- (I) and cyclohepta-amylose. Consts. are recorded for four other modifications of (I). $(C_6H_{10}O_5)_n \cdot I_2 \cdot KI$ has a_0 16.00, c_0 39.7 Å., space-group $D_6^4 \times 5$, with 6 mols. per unit cell. The mechanism of starch hydrolysis is discussed. F. R. G.

Quantitative investigations of amino-acids and peptides. XII. Structural characteristics of some amino-acids. G. Albrecht, G. W. Schnakenberg, M. S. Dunn., and J. D. McCullough (*J. Physical Chem.*, 1943, 47, 24—30).—Photomicrographs, d , axial ratios, space-groups, unit cells, and no. of mols. per unit cell (n) are given for *dl*-valine (I), -threonine (II), -serine (III), -norleucine (IV), -methionine (V), -alanine, -aspartic acid, -glycine, and *l*(+)-glutamic acid. Data for (I)—(V) are: (I) $a:b:c = 0.235:1:0.244$, β 70° 58', space-group $C_2^2-P2_1$; (II) 1.675:1:0.6644, C_{2h}^2-Pmm ; (III) 1.194:1:0.522, 73° 47', $C_{2h}^2-P2_1$; (IV) 3.46:1:2.10, 75° 17', $C_{2h}^2-P2_1$; (V) 2.69:1:3.43, 102° 7', C_2^2-P2 . For each of the acids (I)—(V), $n = 4$. C. R. H.

Structure of molecular compounds. I. Crystal structure of *p*-iodoaniline-*s*-trinitrobenzene. H. M. Powell, G. Huse, and P. W. Cooke (*J.C.S.*, 1943, 153—157).—Crystals of $p-C_6H_4I-NH_2-s-C_6H_3(NO_2)_3$ belong to the space-group $P2_1$, c , the cell dimensions being a 7.43, b 7.39, c 28.3 Å.; β 103° 25'. The unit cell contains 4 mols. There is no evidence of covalency between the two components. The shortest interat. distances are 3.1 and 3.2 Å. between

the N of the NH_2 -group and the two O of a NO_2 -group. All the C—C distances are >3.5 Å. One NO_2 -group approaches the aromatic ring of the $p-C_6H_4I-NH_2$ mol., and mol. interaction may occur here. C. R. H.

Rate of crystal growth in drawn tungsten wires as a function of temperature. C. S. Robinson, jun. (*J. Appl. Physics*, 1942, 13, 647—651).—Large single-crystals of W were grown in wires by vac. heating at const. temp. in the range 1900—2200° K. The growth was followed by observation of the thermionic emission pattern, a cylindrical electron-projection tube with a fluorescent screen being used. The rate of growth increases exponentially with temp., and is smaller in thinner wires. This can be explained by the small grain hypothesis, which supposes that large crystals are formed from fibres, through the stage of small grains. A. J. M.

Variation with temperature of the crystal photo-electric effect. T. Mendelssohn (*Rev. Fac. Sci. Univ. Istanbul*, 1941, 6, 224—236).—Frenkel's diffusion theory predicts proportionality of photo-electric e.m.f. (e) to T at low temp., and decrease of e with increasing T at high temp. Temp. of max. e are calc. for Cu_2O , ZnS , and diamond as -160° , 300° , and 550° . Measurements on Cu_2O show a linear decrease of e with increasing temp. to 110° , a min. followed by a max. val. in the region 110—250°, and a further decrease above 250°. The max. and min. correspond with those of conductivity. Dependence of e on light intensity is more marked at high than at low temp., in better agreement with Frenkel's than with Landau and Lifschitz's theory. Preliminary data for fluorite also show better agreement with Frenkel's theory. L. J. J.

Darkening of materials by light. F. Seitz (*J. Appl. Physics*, 1942, 13, 639—643).—A review dealing with the colorations produced in alkali halide crystals, and the darkening of $AgBr$, ZnS , and $PbCrO_4$. A. J. M.

Optical and photochemical properties of colloidal centres in silver halide crystals. I—III. S. V. Tscherdinzev (*J. Phys. Chem. Russ.*, 1941, 15, 419—429, 430—441, 441—447).—I. Thin (50 μ .) films of $AgCl$ sensitised with $CuCl$ are irradiated with a C arc and the scattering (S) of light by the film and by the individual grains in it is determined in a dark-field apparatus. The $S-\lambda$ curves (λ = wave-length of scattered light) agree with Mie's theory. Long (1 hr.) irradiation of the film with light in the green to red range lowers S , especially for the $\lambda\lambda$ used for irradiation. Violet and ultra-violet irradiation raises S . Heating at 120° gradually eliminates S .

II. $AgCl$ (+ $CuCl$) and $AgBr$ (+ $CuBr$) films, after irradiation with polarised light, exhibit dichroism and "di-tyndallism" (variation of S in a given direction when the plane of polarisation of the incident light vary); di-tyndallism is also shown by individual grains. The reflexion of these films also depends on the direction of polarisation, and both reflexion and S depend on λ in a similar way.

III. Photodichroism etc. are due to destruction of anisotropic Ag grains, the orientation of which coincides with that of polarisation. The mechanism of this destruction is discussed. J. J. B.

Polymorphism of riboflavin. J. A. Means, T. C. Grenfell, and F. H. Hedger (*J. Amer. Pharm. Assoc.*, 1943, 32, 51—53).—An aq. solution of riboflavin (I) saturated at 80° is cooled to room temp., filtered, and the filtrate conc. in vac., to give small needles, m.p. 281—282°. When (I) is heated with less H_2O than is required for complete dissolution, a form of m.p. 295—296° is obtained; conversion of any type of (I) of lower m.p. into these long needles can be followed under the microscope. A third form of (I), plates, m.p. 281—282°, can be isolated when a saturated aq. solution at 100° is cooled to 80° , quickly filtered, and the filtrate allowed to cool slowly. The above facts may help to clarify divergent literature references on m.p. of (I). A. T. P.

IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

Paraffin hydrocarbons. Correlation of physical properties. A. W. Francis (*Ind. Eng. Chem.*, 1943, 35, 442—449).—B.p., d_4^{20} , and n_D^{20} of all the isomerides of C_8-C_{11} paraffins have been calc. from the properties of the next lower paraffin on the assumption that the same change in structure in a portion of a paraffin mol. produces substantially the same change in physical properties regardless of the remainder of the mol. Paraffin isomerides with two branches on non-adjacent C atoms have almost identical b.p. C. R. H.

Vapour pressure of metallic indium. J. S. Anderson (*J.C.S.*, 1943, 141—143).—Data obtained by the effusion method for the v.p. (p) of In show that p can be represented by $\log p = -12,180/T + 8.003$ over the range 727—1075° with a max. error of 8%. The b.p. of In, calc. from the data, is $\sim 2100^\circ/760$ mm. C. R. H.

Thermodynamics of the liquid state. Generalised prediction of properties. K. M. Watson (*Ind. Eng. Chem.*, 1943, 35, 398—406).—On the basis of a modified application of the theorem of corresponding states requiring knowledge only of b.p., crit. temp. and pressure, and liquid d at a given temp., expressions have been derived for predicting the following properties of liquids: thermal expansion

and compressibility, pressure corrections to enthalpy, entropy, and heat capacity at const. pressure, heat of vaporisation, difference between heat capacity of a saturated liquid and its ideal gas, and the difference between heat capacity of a saturated liquid and the heat capacity at const. pressure. C. R. H.

Thermal conductivity of non-metallic single crystals. W. J. Knapp (*J. Amer. Ceram. Soc.*, 1943, 26, 48—55).—Measurements of the thermal conductivity (C) of single crystals (1 cm.³) of quartz, corundum, sapphire, beryl, tourmaline, synthetic LiF, topaz, zircon, and periclase and samples of electrocast mullite, a Na₂O—CaO glass, Pyrex, and pure fused SiO₂ were made at 100—500°. The C of crystals along the various crystallographic axes differed markedly, but the difference decreased at higher temp. Single crystals give a min. C with rising temp., which agrees with Compton's theory. C of glasses increases approx. linearly with temp. J. A. S.

V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

Diffusion of air through monel metal. H. S. Coleman and H. L. Yeagley (*J. Chem. Physics*, 1943, 11, 135—139).—The rate at which atm. gases diffuse through monel metal at various temp. has been determined. A metal tube was closed at one end, and the other end, connected to a vac. system, was heated in a furnace. The diffusion of gases through the metal was determined by noting the rate at which the pressure increased on the inside of the tube. Curves of log (diffusion rate) against $1/(\text{abs. temp.})$ are chiefly linear, but show distortions at 900°, indicating some change in the nature of the metal at this temp., possibly the formation of a solid solution of NiO in Ni, or an order-disorder phenomenon. These breaks are reproducible and are confirmed by dilatometric determinations. A. J. M.

Propagation of supersonic waves in liquid mixtures and intermolecular forces. III. Ether and acetone in chloroform. R. Parshad (*Indian J. Physics*, 1942, 16, 307—315; cf. A., 1942, I, 201).—The adiabatic compressibility—mol. fraction curve for Et₂O—CHCl₃ solutions lies below, whilst that for COMe₂—CHCl₃ solutions lies above, the straight line corresponding to ideal solutions. In the former case the supersonic velocity—mol. fraction curve shows a sharp min. at 25 mol.-% Et₂O. The effect can be explained by preponderance of dipole association in the former and H bond formation in the latter case as the mechanism of mol. interaction. L. J. J.

Refractive index and density of solutions in aqueous alcohol. N. S. Filippova, I. S. Tartakovski, and M. E. Manshelei (*J. Phys. Chem. Russ.*, 1941, 15, 515—524).—Vals. are given for n of several NH₄NO₃ solutions at 15°, 20°, and 25° and several NaOAc solutions at 10°, 15°, and 20°, and for d of several NaOAc solutions at 20°, the solvent in all cases being 68.9 wt.-% EtOH. J. J. B.

Partial specific volumes in binary and ternary solutions. C. Drucker (*Arkiv. Kemi, Min., Geol.*, 1941, 14, A, No. 15, 48 pp.).—Errors arising in the pyknometric method for measuring d are discussed and methods for increasing the accuracy in relative determinations to $\pm 5 \times 10^{-4}\%$ have been developed. The partial sp. vols. (v) in aq. solutions of CO(NH₂)₂, glycine, and salts do not vary linearly with concn. and empirical relations expressing the variation are deduced. v is increased by the presence of a second solute. The effect of ionisation and complex ion formation on v has also been studied. v data for solutions of various org. compounds in C₆H₆ and xylene and of haemoglobin in H₂O and in aq. CO(NH₂)₂ are also recorded. J. W. S.

Statistical mechanics of binary mixtures. F. Kottler (*J. Chem. Physics*, 1943, 11, 153—155).—The direct treatment of the statistical mechanics of binary mixtures by Alfrey *et al.* (A., 1942, I, 293) is not mathematically consistent. A. J. M.

Theory of azeotropic mixtures. V. A. Kireev (*J. Phys. Chem. Russ.*, 1941, 15, 481—491).—The composition of azeotropic mixtures depends on the ratio of the v.p. of the pure components and on the degree of deviation of the v.p. of the mixture from Raoult's law. The temp. coeff. of the composition depends on the difference between the heats of vaporisation of the pure components and the free energy of mixing. J. J. B.

Diffusion in ionic crystals. E. Wietig (*Z. physikal. Chem.*, 1940, B, 45, 374—388).—A method for the investigation of pure diffusion phenomena in crystals of Ba salts is described. A sparingly sol. and a readily sol. Ba salt were mixed, one of them containing a radioactive indicator. After diffusion has taken place the salts are separated by dissolution. The observed migration of the indicator is a measure of the diffusion of the Ba⁺⁺. It is shown that ionic exchange occurs to some extent even at room temp. At higher temp. the diffusion is largely dependent on the degree of compression. The diffusion varies exponentially with temp. The velocity of diffusion of BaSO₄ → BaCl₂ is > for BaCl₂ → BaSO₄ at the same temp. The diffusion velocity at const. temp. is largely dependent on changes brought about in the crystals by repeated compression. A. J. M.

Solubility of solid methane in liquid nitrogen and oxygen. V. G. Fastovski and J. A. Krestinski (*J. Phys. Chem. Russ.*, 1941, 15, 525—531).—The mol. fraction N of CH₄ in its saturated solutions in N₂ between 70° and 79° K. and in O₂ between 69° and 74° K. satisfies the equations $\log N = 1.36576 - 120.48/T$ and $\log N = 0.97986 - 85.822/T$ respectively. J. J. B.

Distribution equilibria in the system tin-stannous sulphide. J. S. Anderson and M. J. Ridge (*Trans. Faraday Soc.*, 1943, 39, 93—98; cf. A., 1943, I, 181).—The distribution of Cu, Ag, and Pb, present in low total concn., between the two liquid phases at 910° is such that Pb is slightly and Ag strongly conc. in the metallic phase, whilst Cu is conc. preferentially in the sulphide phase. Distributions calc. from thermodynamic data do not agree with those observed. F. L. U.

Equilibrium and surface phenomena in the system phenol-sodium oleate-water. III. N. N. Petin and K. V. Toptschieva (*J. Phys. Chem. Russ.*, 1941, 15, 507—514).—Distribution of Na oleate between PhOH and H₂O, and the electric conductivity of the co-existing layers, are measured. The interfacial tension between the layers increases with the concn. of Na oleate although the miscibility increases as well. J. J. B.

Interfacial-tension studies of sodium laurate solutions. J. K. Davis and F. E. Bartell (*J. Physical Chem.*, 1943, 47, 40—50).—The pendent-drop method has been used to measure the interfacial tension (γ) at the dineric boundary between aq. Na laurate (I) and *n*-C₁₇H₃₅. For unhydrolysed solutions of (I) (pH ~11) ageing lowers γ only slightly, but in more acid solutions there is a rapid decrease of γ with time. This lowering is due to the migration of free lauric acid across the interface, thus disturbing the equilibrium so that more of (I) hydrolyses and γ decreases progressively. For good emulsification there must be high concns. of (I) in the aq. phase and of lauric acid in the non-polar liquid. C. R. H.

Structure of collodion membrane and its electrical behaviour. VI. Protamine-collodion membrane, a new electropositive membrane. I. Abrams and K. Sollner (*J. Gen. Physiol.*, 1943, 26, 369—379; cf. A., 1943, I, 125).—Strongly electropositive porous membranes are obtained when salmine is adsorbed on porous collodion membranes, and they retain their characteristic electrochemical properties unaltered for at least 1 year. They are distinctly electropositive between pH 1 and 10, the max. effect being observed between pH 3 and 8. The rates of filtration and ohmic resistance of these membranes are very similar to those of similar uncoated membranes. The porous protamine-collodion membranes exhibit very marked positive anomalous osmosis and the behaviour observed with proper electrolytes is similar to that of oxidised collodion membranes. They also show very pronounced negative osmosis with strong acids. Protamine-collodion membranes which correspond in properties with activated dried collodion membranes are formed by adsorption of protamine on porous collodion membranes followed by drying in air. The concn. potentials across such membranes approach the thermodynamically possible max. J. N. A.

Electrical capacity of the double layer. W. G. Eversole and C. R. Estee (*J. Chem. Physics*, 1943, 11, 156).—The range of potentials and concns. for which the equations previously put forward (A., 1943, I, 128) are reasonably valid are obtained. A. J. M.

Rapid method of dialysis.—See A., 1943, I, 167.

Freezing out of colloids and colloid mixtures with reference to the plasmatic resistance of plants to frost.—See A., 1943, III, 426.

Behaviour of thixotropic colloids under pressure. I. Setting of iron hydroxide. O. I. Leipunski and P. E. Frank (*J. Phys. Chem. Russ.*, 1941, 15, 504—506).—The time of setting of thixotropic Fe(OH)₃ sols is increased by keeping the sol at a high pressure (<2000 atm.) for ~1 hr. J. J. B.

Gel formation by mutual interaction of oppositely charged sols. M. Prasad and S. D. Mehta (*Current Sci.*, 1943, 12, 19).—Gels have been obtained on mixing a sol of Al(OH)₃ with sols of MnO₂, Sb₂S₃, and silicic acid, and Fe(OH)₃ sol with silicic acid. W. R. A.

Osmotic pressures of polyvinyl chloride solutions by a dynamic method. R. M. Fuoss and D. J. Mead (*J. Physical Chem.*, 1943, 47, 59—70).—A dynamic osmometer suitable for solutions in org. solvents has been designed and its application to the measurement of the osmotic pressure of COMe·C₂H₅ solutions of vinyl chloride polymers is described. The vals. agree with those obtained viscometrically and by the ultracentrifuge method. C. R. H.

Heat capacity and bound water in starch suspensions. M. E. Freeman (*Arch. Biochem.*, 1942, 1, 27—39).—Starch-H₂O mixtures and dextrin sols have abnormally high thermal capacities. With increasing temp. bound H₂O decreases and heat is absorbed in the process. Robinson's equation for the sp. heat of biological systems (A., 1931, 1177) is invalid for starch and dextrin systems. A max. of 23% of H₂O is adsorbed by starch and a part of this is desorbed when the temp. rises from 0° to 40°. Sand-H₂O mixtures behave normally. E. R. S.

Reactions of cellulose in liquid sulphur dioxide.—See B., 1943, II, 179.

Structure of μ -peroxo- $\text{Co}^{\text{III}}\text{--Co}^{\text{IV}}$ -ammines. L. Malatesta (*Gazzetta*, 1942, 72, 287—292).—The salts $[(\text{NH}_3)_5\text{Co}^{\text{III}}\text{--O}_2\text{--Co}^{\text{IV}}(\text{NH}_3)_5](\text{NO}_3)_5$.

$[(\text{NH}_3)_4\text{Co}^{\text{III}}\text{--O}_2\text{--Co}^{\text{IV}}(\text{NH}_3)_4](\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$, and

$[\text{en}_2\text{Co}^{\text{III}}\text{--O}_2\text{--Co}^{\text{IV}}\text{en}_2](\text{NO}_3)_4$ [en = $(\text{CH}_2\text{--NH}_2)_2$] all have a magnetic moment of 1.6—1.7 Bohr magnetons at 18°. It is suggested that they exhibit the following mesomerism: $[\text{Co}^{\text{III}}\text{--O}_2\text{--Co}^{\text{IV}}] \rightleftharpoons [\text{Co}^{\text{III}}\text{--O}_2 \rightarrow \text{Co}^{\text{III}}] \rightleftharpoons [\text{Co}^{\text{III}} \leftarrow \text{O}_2\text{--Co}^{\text{IV}}] \rightleftharpoons [\text{Co}^{\text{IV}}\text{--O}_2\text{--Co}^{\text{III}}]$.

E. W. W.

VI.—KINETIC THEORY. THERMODYNAMICS.

Quantitative investigations of amino-acids and peptides. X. Equilibria between amino-acids and formaldehyde. Leucine and *N*-methyl-leucine. XI. Equilibria between amino-acids and formaldehyde. Glutamic acid. E. H. Frieden, M. S. Dunn, and C. D. Coryell (*J. Physical Chem.*, 1943, 47, 10—20, 20—24).—X. The equilibrium between CH_2O and *d*(–)-*N*-methyl-leucine has been examined by polarimetric and potentiometric methods and that between CH_2O and *l*(–)-leucine has been examined polarimetrically. The equilibrium consts. for the latter system agree with potentiometric data by other investigators. The equilibrium const. of the former system as determined polarimetrically is approx. half of that obtained potentiometrically. A general solution for the four parameter equations denoting the change in rotation of leucine solutions on addition of CH_2O is given.

XI. Equilibrium consts. for the CH_2O –*l*(+)-glutamic acid system obtained polarimetrically are > vals. obtained potentiometrically.

C. R. H.

Theory of the isoelectric point. IV. Applications to weak acids and bases and to their intermediate salts. The relative isoelectric point. T. L. Hill (*J. Physical Chem.*, 1943, 47, 70—83).—Theoretical. The previous treatment (cf. A., 1942, I, 267, 328, 367) is extended to solutions saturated with respect to salts of weak acids and bases. The relative isoelectric point is defined and shown to include the ordinary isoelectric point as a special case. With its aid ampholytes, weak acids, and weak bases, and salts of all these can be considered as members of one class and treated simultaneously.

C. R. H.

Activity coefficients of zinc chloride, bromide, and iodide from electromotive forces. (Miss) D. M. Egan and J. R. Partington (*J.C.S.*, 1943, 157—168).—Published activity coeff. data are reviewed. Activity coeffs. of ZnCl_2 (0.5—0.001M), ZnBr_2 (0.36—0.001M), and ZnI_2 (0.25—0.002M) have been calc. from e.m.f. data at 25° and 35° by a graphical extrapolation method and by correlation with La Mer's equation. La Mer's equation gives good agreement with experiment in the case of ZnCl_2 and ZnBr_2 , which evidently behave as strong electrolytes, but the coeffs. for ZnI_2 are < the calc. vals., especially in conc. solutions. The data can be explained by the formation of a complex anion ZnI_3^- or ZnI_4^{2-} .

C. R. H.

Activity coefficient of potassium iodide in sulphur dioxide from vapour pressure measurements. W. G. Eversole and A. J. Hanson (*J. Physical Chem.*, 1943, 47, 1—9).—The activity coeff. (*f*) of KI dissolved in liquid SO_2 has been calc. from v.p. data at 10°, 15°, 20°, and 25° and over the concn. range 0—3M. The vals. of *f* range from ~0.8 at the lowest to 0.005—0.008 at the highest concns. When log *f* is plotted against \sqrt{N} , where *N* = mol. fraction of solute, the resulting curve shows three distinct regions. From *N* = 0 to 0.015 it is linear and corresponds with the Debye theory, between 0.015 and 0.18 it is exponential, and above 0.18 it passes through a min. at *N* = ~0.20. Solvation, with the consequent immobilisation of solvent mols., is suggested as the cause of this min.

C. R. H.

System tin-stannous sulphide. J. S. Anderson and M. J. Ridge (*Trans. Faraday Soc.*, 1943, 39, 98—102).—The composition of the conjugate liquid phases has been determined from the m.p. (858°) to 1180°, over which range there is little change (S 2.2—2.5% in metal phase, 19.7—19.9% in sulphide phase). (Cf. A., 1943, I, 180.)

F. L. U.

Application of the method of conodes to drawing of univariant curves in the systems of eutectic mixtures of three and four components forming solid solutions. D. A. Petrov (*J. Phys. Chem. Russ.*, 1941, 15, 500—503).—Geometrical.

J. J. B.

System $\text{CaO--SiO}_2\text{--P}_2\text{O}_5$. R. L. Barrett and W. J. McCaughey (*Amer. Min.*, 1942, 27, 680—695).—The equilibrium diagram is given. The solid phases have been identified by their optical properties and X-ray diffraction data. In addition to known binary compounds, two ternary phases, nagelschmidtite (I) and silicocarnotite (II), hitherto known in certain slags, exist in the

system. The diagram shows an extensive region of liquid immiscibility in which two liquids in equilibrium with cristobalite are formed. Extensive solid solution prevails in the phases Ca_2SiO_4 (I), (II), and $\text{Ca}_2(\text{PO}_4)_2$, which form a binary system with Ca_2SiO_4 and $\text{Ca}_2(\text{PO}_4)_2$ as end members. Ca_2SiO_4 may contain up to 10% P_2O_5 in solid solution, and (I) ($\text{Ca}_2\text{Si}_2\text{P}_2\text{O}_{14}$) can have 12—24% P_2O_5 . A binary diagram showing homogeneity ranges and variation in *n* resulting from solid solution is given. *n* decreases as P_2O_5 content increases.

L. S. T.

Ternary iron-zirconium-sulphur system. R. Vogel and A. Hartung (*Arch. Eisenhüttenw.*, 1942, 18, 413—418; *Bull. Iron Steel Inst.*, 1943, No. 88, 222A).—The constitutional diagram of the Fe-FeS-ZrS₂-Fe₂Zr system has been constructed from the results of thermal, chemical, and microstructural studies. In the liquid phase there is a large miscibility gap. The m.p. of synthetic ZrS₂ was ~1550°. The diagram for the FeS-ZrS₂ system was developed.

R. B. C.

Laboratory determination of the heat of transition of sulphur. P. P. Sutton (*J. Chem. Educ.*, 1942, 19, 459).

L. S. T.

Pressure and composition of the vapour and heat of vaporisation of methanol-chloroform mixtures, and change of free energy and entropy associated with their formation. V. A. Kireev and I. P. Sitnikov (*J. Phys. Chem. Russ.*, 1941, 15, 492—499).—Total and partial v.p. of MeOH-CHCl₃ mixtures are measured at 20°, 35°, and 49.3°; the azeotropic mixtures contain 74.5, 70.0, and 65.9 mol.-% of CHCl₃ respectively. Free energy and entropy of mixing are calc.

J. J. B.

VII.—ELECTROCHEMISTRY.

Ohmic resistance of local elements in dissolution of metals in acids. V. G. Levitsch and A. N. Frumkin (*J. Phys. Chem. Russ.*, 1941, 15, 748—759).—Resistance is max. at the centre of the cathode (a small disc of Sb or Zn embedded in a large Pb or Ni anode, the whole being immersed in 8N-H₂SO₄), and is expressed by $2r/\pi\kappa$ ohms per sq. cm., where *r* is the radius of the disc, and *κ* is the sp. conductivity of the electrolyte. In the case of a Zn cathode in Ni, *r* = 10⁻⁴ cm. and the ohmic fall of potential is > 13 mv.

R. T.

Electrode potentials of metals. A. H. Turnbull and H. C. Davis (*Aero. Res. Com. Rept. Mem.*, No. 1901, 1942, 16 pp.).—The p.d. between a saturated Hg₂Cl₂ electrode and 48 metals, alloys, and plated specimens have been determined at 22°. Sea-H₂O and 3% NaCl were used as electrolytes. With the exception of Ag-plated Cu, all the specimens were electronegative with respect to Hg₂Cl₂. The influence of abrasion of the metal surface is discussed. Abrasion is advised before measuring potentials so as to remove protective films, but the abrasion should be light so as to avoid cold-working the specimen.

C. R. H.

Diffusion potentials in models and living cells.—See A., 1943, III, 425.

Movement of solution near a dropping cathode. II. Velocity of movement of solution and increase of the current strength on the polarographic curve "current strength-voltage." T. A. Kriukova and B. N. Kabanov (*J. Phys. Chem. Russ.*, 1941, 15, 475—480).—The additional current strength due to the stirring of the solution by the expanding Hg drop is $\propto clv$, *c* being the concn. of the ions which are reduced at the cathode, *l* their mobility, and *v* the velocity of the solution near the drop; *v* is determined by observing graphite particles suspended in the solution. This proportionality is confirmed for Cd, Pb, Mn, Co, Cu, Fe, Cr, and Th ions in conc. KCl solution.

J. J. B.

Conductometric titrations. I. Titration of acids of varying strength in acetone-water mixtures. II. Analysis of complex mixtures of acids and salts. R. S. Airs and M. P. Balfe (*Trans. Faraday Soc.*, 1943, 39, 102—107, 107—114).—I. Curves are given for the titration of HCl, H₂SO₄, H₂SO₃, H₂C₂O₄, PhSO₃H, HCO₂H, AcOH, and tartaric and picric acids in aq. COMe₂ (30—90%), chiefly at a concn. of 0.002N, with 0.1N alcoholic NaOH. Acids with *pK* < 2 are exactly titrated at the min. conductivity (*κ*_{min}) when the solvent contains > 40% of COMe₂, whilst those with *pK* < 1 are similarly neutralised in > 80% of COMe₂. Vals. of *κ*_{min} for the weaker (*pK* > 2) acids in aq. COMe₂ do not correspond with complete neutralisation; e.g., with AcOH < 2% is titrated at *κ*_{min} in 40% COMe₂. H₂SO₄ behaves as a monobasic acid in 80% and as a dibasic acid in 40% COMe₂, and at intermediate concns. *κ*_{min} moves progressively between the first and second neutralisations. The first dissociations of H₂SO₃ and of H₂C₂O₄ are exactly neutralised at *κ*_{min} in 40% COMe₂, whilst that of tartaric acid is incompletely neutralised.

II. Acids present in a dil. aq. solution are classified by conductometric titration in 80% COMe₂ (A), 40% COMe₂ (B), and H₂O (C). Strong acids (*pK* < 1) are recorded in A, those of *pK* 1—2 are equiv. to B—A, and those of *pK* 2—7 to C—B. Salt content is determined by the difference between titrations before and after the bases have been removed by treatment of the solution with a

synthetic resin. The procedure described is designed primarily for the examination of tanning liquors; it records all carboxylic acids and in general excludes phenolic groups. F. L. U.

VIII.—REACTIONS.

Mechanisms of ignition of gas mixtures. M. V. Poljakov and L. P. Kuleshina (*J. Phys. Chem. Russ.*, 1941, 15, 470—474).—The min. pressure at which $\text{CH}_4\text{--O}_2\text{--N}_2$ mixtures can be ignited by a hot wire conforms to Semenov's equation $d^2P_1P_2/[1 + \alpha P_3/(P_1 + P_2)] = \text{const.}$, where P_1 , P_2 , and P_3 are the pressures of CH_4 , O_2 , and N_2 respectively, and d is the diameter of the reaction vessel. The validity of this equation depends on the existence of an induction period; it is not valid when the gas is ignited by a spark. J. J. B.

Influence of temperature on the detonation limit of hydrogen-air mixtures. I. M. A. Rivin. II. A. S. Sokolik (*J. Phys. Chem. Russ.*, 1941, 15, 533—550, 551—555).—I. Sokolik's work (cf. A., 1940, I, 29) is criticised and the mechanism of propagation of the detonation wave discussed in detail.

II. A reply.

J. J. B.

Master reaction in oxidation chains. R. W. Gurney (*Arkiv Kemi, Min., Geol.*, 1941, 14, B, No. 17, 4 pp.).—For chain reactions in which each mol. of one substance reacts alternately with mols. of two other substances it is shown that the max. rate of the whole chain process is equal to that of the slowest link if the links adjacent to the slowest link are very much more rapid. The presence of other slow links is immaterial provided they are not adjacent to the slowest link. J. W. S.

Electrostatic influence of substituents on reaction rates. IV. D. Price and F. H. Westheimer (*J. Chem. Physics*, 1943, 11, 150—153).—Rates of hydrolysis of EtOBz , Et toluate and anisate , $p\text{-C}_6\text{H}_4\text{Cl}\cdot\text{CO}_2\text{Et}$, and $p\text{-NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{Et}$ have been determined in $\text{EtOH--H}_2\text{O}$ mixtures (30, 60, and 90% EtOH) at 50° . The relative rates of hydrolysis of the above compounds are compared with the vals. calc. by the Kirkwood and Westheimer theory (cf. A., 1938, I, 574; 1939, I, 472). A. J. M.

Reaction mechanism in double decomposition between oxides and salts of oxy-acids in powder mixtures. I. R. Jagitsch (*Arkiv Kemi, Min., Geol.*, 1942, 15, A, No. 17, 37 pp.).—The phenomena of reaction kinetics in solid mixtures are briefly reviewed. A study of self-diffusion processes in MgO , CaO , SrO , and BaO by a radioactive indicator method shows that dissociation of the oxides does not account for the constancy of the temp. (T_r) at which their reactions with oxy-salts become detectable by thermal effects. Data for the extent of metathesis after heating for const. time at different temp. are given for the systems $\text{CaO--Ag}_3\text{PO}_4$, $\text{--Co}_3(\text{PO}_4)_2$, --CoSO_4 , $\text{SrO--Ag}_3\text{PO}_4$, $\text{MgO--Ag}_3\text{PO}_4$, $\text{--Co}_3(\text{PO}_4)_2$, --CoSO_4 , and $\text{BaO--Ag}_3\text{PO}_4$. For the four oxides T_r/T_s (where $T_s = \text{m.p.}$) = ~ 0.277 ; reaction is governed by transfer of particles from the oxide into the oxy-salt phase, and not by diffusion of anhydride mols. from the oxy-salt into the oxide. Absorption of CO_2 by powdered CaO or SrO and of SO_3 by CaO proceeds only until a certain fraction of the oxide, which is const. at a given temp., has reacted. Reaction between MgO and CoSO_4 at an interface between compressed tablets occurs only in the surface layers, showing that lattice diffusion does not occur. These results are discussed with reference to the mechanism of reaction in the systems considered. A. J. E. W.

Transition state theory of formation of thin oxide films on metals. E. A. Gulbransen (*Trans. Electrochem. Soc.*, 1943, 83, Preprint 4, 13 pp.; cf. B., 1942, I, 351; A., 1943, I, 68).—The transition state theory of diffusion is applied to the rate of oxidation of metals as a function of temp. The expression involves an entropy as well as an energy of activation. The oxidation of Fe, stainless steel, and Cu follows the parabolic law for certain temp. and pressure ranges after an initial period. The rate coeffs. lie on a straight line when $\log K$ is plotted against T^{-1} . Energies of activation of 22,600, 29,600, and 24,900 g.-cal. and entropies of activation of -31 , -35 , and -6.8 g.-cal. per 1° are found for Fe, stainless steel, and Cu, respectively. The importance of entropy factor is considered briefly. C. E. H.

Anticatalysis and temperature, mutual restriction and auto-restriction. E. Baur and H. Riif (*Helv. Chim. Acta*, 1943, 26, 441—449).—The diminution of the rate of oxidation of quinol (I) due to $p\text{-NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{H}$ is nearly independent of the temp. Mutual restriction is shown by $\text{SO}_3\text{--(I)}$, PhCHO--(I) and metol--(I) . Evidence of autorestriction is found in the oxidation of (I) in the absence of added inhibitor. H. W.

Surface recombination of H atoms and OH radicals. W. V. Smith (*J. Chem. Physics*, 1943, 11, 110—125).—Atoms formed by a low-pressure gas discharge are allowed to diffuse through a side arm, part of the surface of which is coated with the material under test. The atoms which pass through the side arm are detected by the heat of recombination liberated at a small surface coated with a highly catalytic substance (Pt for H, and KCl for OH). By varying the distance of this test surface the decay in at. concn. with distance

can be found, and hence the coeff. of recombination, γ . γ has been found for H and OH on Pyrex for a temp. range of 500° . Vals. of $\gamma \sim 10^{-5}$ are obtained at room temp. The recombination of H on a no. of compounds (KCl , KOH , K_2CO_3 , K_2SiO_3 , Na_3PO_4) has been determined over smaller temp. ranges. γ depends to a great extent on the dryness of the surface. All salts investigated, except KCl, cause strong recombination of H when dry, but only slight recombination when damp. KCl causes strong recombination of OH. A dehydrogenating catalyst ($\text{ZnO}\cdot\text{Cr}_2\text{O}_3$) and a dehydrating catalyst (Al_2O_3) showed no difference in the promotion of H and OH recombination. A. J. M.

Catalytic alkylation of benzene with ethylene.—See B., 1943, II, 165.

Catalytic oxidations of naphthalene series.—See B., 1943, II, 166.

Electrolysis of mixtures of nitrate with malonic acid, ethyl- and dimethyl-malonic acid, and succinic acid.—See A., 1942, II, 183.

Photographic action of electrons in the range 40—212 kv. R. J. Baker, E. G. Ramberg, and J. Hillier (*J. Appl. Physics*, 1943, 14, 39).—Errata (cf. A., 1942, I, 373).

IX.—PREPARATION OF INORGANIC SUBSTANCES.

Reagent chemicals—preparation and properties. G. Dimsey (*Soc. Chem. Ind. Victoria J.*, 1942, 42, 396—405).—A review.

Nascent state. J. H. Reedy and E. D. Biggers (*J. Chem. Educ.*, 1942, 19, 403—406).—Theories concerning nascent action are reviewed, and some additional experiments recorded. L. S. T.

Progress in the preparation and determination of the properties of boron. A. W. Laubengayer, A. E. Newkirk, and R. L. Brandaur (*J. Chem. Educ.*, 1942, 19, 382—385).—A review. L. S. T.

Thalious salts as derivatives of sulphonic acids.—See A., 1943, II, 157.

Preparation of ammonium hydroxide in the laboratory. L. E. West and A. Wilson (*J. Chem. Educ.*, 1942, 19, 418—419).— NH_3 from a cylinder is passed into H_2O in a 40-l. carboy which is cooled externally by running H_2O sprayed from a ring burner fitted over the neck. L. S. T.

X.—ANALYSIS.

Determination of water in absolute alcohol.—See B., 1943, III, 127.

Determination of water [in coal] by distillation with xylene.—See B., 1943, I, 229.

Determination of high chlorine residuals [in water].—See B., 1943, III, 114.

Determination of iodate in presence of bromate and chlorate. I. M. Kolthoff and D. N. Hume (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 174—175).— IO_3^- can be determined iodometrically in presence of a four-fold excess of BrO_3^- or ClO_3^- in a solution buffered to pH 4.0 by means of H phthalate. pH increases during the reaction between IO_3^- and I^- to a val. at which the rate of reaction between BrO_3^- and I^- is negligibly small. Details of procedure, and data showing the effect of H phthalate and BrO_3^- concns. on accuracy, are recorded. L. S. T.

Simple determination of hydrogen sulphide [in sewage or sewage gas].—See B., 1943, III, 138.

Determination of sulphur dioxide in beer.—See B., 1943, III, 127.

Rapid qualitative test for tellurium [in minerals]. H. Goudey (*Amer. Min.*, 1942, 27, 592).—A fragment of the mineral is heated in the reducing blow-pipe flame in an inclined porcelain crucible, and the black sublimate of Te dissolved in conc. H_2SO_4 to give the usual red colour. The test is applicable to all types of Te minerals. L. S. T.

Assay of iron and ammonium citro-arsenite for arsenic trioxide.—See B., 1943, III, 108.

Determination of hydrocyanic acid produced by almonds.—See B., 1943, III, 105.

Effect of ethyl alcohol concentration on purity of potassium platini-chloride in determination of potash in fertilisers.—See B., 1943, III, 119.

Selective reagent for lithium. Application to the rapid volumetric determination of lithium in presence of potassium and sodium. L. B. Rogers and E. R. Caley (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 209—211).—Li is quantitatively pptd. as a complex periodate by aq. $\text{KOH} + \text{KIO}_4$. With 1 ml. each of reagent and test solution at 70° , 0.1 mg. of Li can be detected. Na^+ , K^+ , and NH_4^+ give no ppt., but NH_4^+ reduces the sensitivity of the test. Metals must be absent, but Cl^- , NO_3^- , SO_4^{2-} , and moderate concns. of acids do not interfere. The ppt. is insol. only in strongly alkaline solutions. The ratio of Li : I is not stoichiometric, but under controlled conditions of pptn. is sufficiently const. to permit iodometric determination of the IO_3^- with KI and $\text{Na}_2\text{S}_2\text{O}_3$, or aq. Na_3AsO_3 . A gravimetric determin-

ation is not possible. Details of procedure, and test data for Li, alone and in presence of Na, NH_4^+ , dil. HCl, HClO_4 , KNO_3 , and K_2SO_4 , are recorded. L. S. T.

Semi-micro-determination of silver. S. Reznick (*J. Assoc. Off. Agric. Chem.*, 1943, 26, 155—157).—Ag is pptd. as AgI, which is treated with Br, affording $\text{AgBr} + \text{HIO}_3$; KI is then added, and the liberated I is titrated. The error, using ~ 1 mg. is $\sim 2\%$. A. A. E.

Electrolytic determination of zinc in aluminium alloys.—See B., 1943, I, 254.

[Determination of] lead. Dithizone method and its interferences. P. A. Clifford (*J. Assoc. Off. Agric. Chem.*, 1943, 26, 26—53).—A list is given of metals which form dithizone (I) complexes, together with the pH of reaction, colours in CCl_4 , and absorption max. in CCl_4 . Photometric methods of detection of interference by Bi and Sn are given. Procedure for the separation of small quantities of Pb and Tl is outlined. The method is satisfactory for the determination of Pb in urine; Cu, Zn, and oxidation products of (I) do not interfere. A. A. E.

Qualitative analysis of microgram samples. Separation, estimation, and identification of the more common ions of the hydrogen sulphide group. A. A. Benedetti-Pichler and M. Cejola (*Ind. Eng. Chem. Anal.*, 1943, 15, 227—230).—The technique previously described (A., 1943, I, 68) has been applied to analyses requiring long separations, followed by sedimentation estimations, and confirmatory tests. Improvements in manipulation are described, and a method for fractionally distilling 0.1 to 0.01 cu. mm. of liquid has been developed. The complete analysis of 1 μg . of Wood's alloy requires ~ 12 hr. In 0.01 cu. mm. of a solution containing 0.1 μg . each of Cu^{++} , As, Sb, and Sn, 0.1, 0.06, 0.1, and 0.24 μg . of the respective ions were found: in 0.01 cu. mm. containing 0.1 μg . each of Hg^{++} , Pb, Bi, Cd, and Sb, 0.1 μg . of Hg, Pb, Bi, and Sb and 0.8 μg . of Cd were found. L. S. T.

Assay of mercury in certain [medicinal] organic compounds.—See B., 1943, II, 109.

Analysis of pigments.—See B., 1943, II, 191.

Colorimetric determination of chromium in [tannery] exhaust liquors.—See B., 1943, II, 202.

Spectrochemical determination of tungsten in siliceous material. L. H. Ahrens (*J. S. African Chem. Inst.*, 1943, 26, 21—26).—The method described uses Si as an internal standard. For a range of 0.03—5.0% WO_3 , the mean error is $\sim 4.5\%$ of the total, and 6.5% when much Fe is present. 30—40 determinations per day can be made. L. S. T.

Decomposition of tin alloys with hydrochloric acid and the iodometric determination of tin.—See B., 1943, I, 253.

XI.—APPARATUS ETC.

Electrically-heated m.p. apparatus. E. Dowzard and M. Russo (*Ind. Eng. Chem. Anal.*, 1943, 15, 219—221).—Apparatus designed to give the heating ratio prescribed by the U.S. Pharmacopæia is described. L. S. T.

Activating light sources for luminescent materials. E. W. Beggs (*J. Opt. Soc. Amer.*, 1943, 33, 61—70).—The relative efficiency for activation of phosphors and fluorescent materials of high- and low-pressure Hg vapour, fluorescent, A glow, and 60-w. filament lamps have been examined. Their respective ranges of technical application are discussed. L. J. J.

Mercury arc lamps: effect of electrode on energy distribution. W. T. Anderson, jun., (*J. Opt. Soc. Amer.*, 1943, 33, 104—108).—The spectral energy distribution of the radiation from two identical high-pressure Hg arc lamps, one with pure W electrodes and one with Ba-activated W electrodes, has been compared at standard total radiation. Ba activation reduces the work function of the electrodes from 4.53 to 1.1 v. For max. ultra-violet emission, activated electrodes of low work function acting at low temp. are necessary. With such electrodes the rate of ultra-violet depreciation is also diminished. L. J. J.

Grating spectrograph for use in qualitative analysis. W. S. von Arx (*J. Chem. Educ.*, 1942, 19, 407—410). L. S. T.

Use of powders in spectrochemical analysis. A. E. Ruehle and E. K. Jaycox (*J. Opt. Soc. Amer.*, 1943, 33, 109—112).—A method employing dry oxide-nitrate mixtures, applicable to Pb-Sn solders, is described. L. J. J.

Analytical experiments in spectrophotometry. M. G. Mellon (*J. Chem. Educ.*, 1942, 19, 415—418).—Experiments designed to serve as an introduction to the use of spectrophotometers in chemical analysis are described. L. S. T.

Spectrophotometer [in the textile industry].—See B., 1943, II, 153.

[Apparatus for] absorption spectro-analytical determinations of small samples of mixtures of volatile organic substances.—See B., 1943, II, 165.

Primary standard of wave-length. W. F. Meggers (*Rev. Mod. Physics*, 1942, 14, 59—63).—The use of the Michelson Cd lamp and of commercial Cd-vapour lamps for providing the Cd red line as a λ standard is discussed. The desirable characteristics of a primary standard of λ are discussed, and it is shown that these conditions are best fulfilled by the Cd red line as proposed by Michelson. A. J. M.

Construction and use of reflexion echelons. W. E. Williams (*Rev. Mod. Physics*, 1942, 14, 64—65).—The reflexion echelon can be converted into a λ -measuring device which will give vac. $\lambda\lambda$ directly without compensation for phase change variation as in the Fabry-Perot interferometer. The theory of the echelon is extended to cover line displacement due to the intensity envelope of the echelon and the non-linearity of echelon dispersion. Corrections for these errors have been made to a group of Fe lines. The n and dispersion of normal air is best given by the dispersion curve of Meggers and Peters displaced upwards by a const. amount of 0.0032 Å. A. J. M.

Identification of orders and ghosts in grating spectra by diffracting slits. H. S. Pomerance and H. G. Buntler (*Rev. Mod. Physics*, 1942, 14, 66—67).—The λ of various orders in a grating spectrum can be directly indicated on the plates by using the direction of the spectral lines as a co-ordinate for a diffraction pattern which is narrow enough to show several orders. The distance between the diffraction mm. is then a measure of λ . The various overlapping orders differentiate themselves by the widths of their patterns, which are in the ratio of small integers, viz., the reciprocals of the orders. The Lyman ghosts do not fit into this system. The widths of their diffraction patterns indicate their true λ . A disadvantage of the method is the low intensity of extended patterns, involving long exposures. A. J. M.

Spectrophotometric determination of Lovibond number in brown Lovibond glasses series No. 52, Brewer's scale. G. F. Beyer (*J. Assoc. Off. Agric. Chem.*, 1943, 26, 164—171).—A method for correlating spectral transmittance of the glasses to the Lovibond no. has been developed. Calculations may be eliminated by means of a graph. A. A. E.

Light-and-shadow box as visual aid in measuring spectra. J. J. Hopfield (*J. Opt. Soc. Amer.*, 1943, 33, 113—115). L. J. J.

Beryllium windows for permanently evacuated X-ray tubes. H. Brackney and Z. J. Atlee (*Rev. Sci. Instr.*, 1943, 14, 59—63).—Pure Be, e.g., 0.030 in. thick, is superior in X-ray transmission to Lindemann glass, e.g., 0.015 in. thick, and makes Cr target diffraction tubes practicable. The use of Be windows >0.010 in. thick is possible. L. J. J.

High-index medium for rapid impregnation of friable materials. C. P. Kaiser and H. T. U. Smith (*Amer. Min.*, 1942, 27, 590—591).—Aroclor 4465, n 1.66—, is used. L. S. T.

Tube-length in photomicrography. J. R. Baker (*J. Roy. Microscop. Soc.*, 1942, [iii], 62, 112—115).—The correction of the visual focus of a microscope to the focus required for use with a camera is achieved by extending the draw-tube to an extent which can be permanently predetermined, and depends wholly on the eyepiece. Advantages are summarised. N. M. B.

Crystallographic microscopy. E. E. Jelley (*J. Roy. Microscop. Soc.*, 1942, [iii], 62, 93—102).—A historical review (with detailed bibliography) summarising the principles bearing on, and the use of, the polarising microscope and its accessory apparatus in various applications of optical crystallography, with special reference to chemical microscopy. N. M. B.

Photo-electric polarimeter. E. J. B. Willey (*J. Sci. Instr.*, 1943, 20, 74—75).—A polarimeter, in which polaroid replaces the Nicol prisms, permitting wider apertures so that the amount of transmitted light is sufficient for photoelectric measurement, is described. C. R. H.

New capillary electrometer as a galvanometer substitute. F. A. Uhl (*Z. anal. Chem.*, 1942, 124, 324—327). L. S. T.

Electron microscopy in chemistry. V. K. Zworykin (*Ind. Eng. Chem.*, 1943, 35, 450—458).—Applications of the electron microscope to chemistry are discussed and illustrated by photomicrographs. C. R. H.

Geiger-Mueller counter pulse size. C. W. Miller (*Rev. Sci. Instr.*, 1943, 14, 68—76).—The effect of overvoltage and pressure on pulse size and pulse distribution has been examined for gas mixtures 90% He-H₂, 90% Ne-H₂, 90% A-H₂, 100% H₂, and 90% A-O₂ at 2—30 cm. Hg, and 9.7 cm. A + 1.2 cm. EtOH. L. J. J.

Distillation receiver for use with the Tate and Warren apparatus. N. B. Biggs (*Analyst*, 1943, 68, 147—148).—A large receiver is used to replace the graduated receiver after the normal distillation and the immiscible solvent is recovered. S. B.

High-vacuum technique. G. Burrows (*J. Sci. Instr.*, 1943, 20, 77—78).—Some points raised in an earlier paper (cf. A., 1943, I, 103) are clarified. The reduction of effective pumping speed caused by a cold trap refers only to the "catalogue" val. of the pumping speed. The trap may bring about an increase in overall speed if a

large proportion of vapour condenses in the trap. In connexion with the "compressed-air-under- H_2O " test, a method of calculating the probable size and rate of formation of bubbles due to a given leak is given. C. R. H.

Vacuum desiccator for the synthetic organic laboratory. F. P. Pingert (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 175). L. S. T.

Low-temperature vacuum drying apparatus. D. H. Cook (*J. Chem. Educ.*, 1942, 19, 427, 434). L. S. T.

Vacuum-operated continuous extractor. M. C. Shelesnyak, M. S. Biskind, and M. M. Schwarzschild (*Amer. J. clin. Path. Tech. Sect.*, 1942, 6, 96—98).—The apparatus described utilises pressure changes in place of the usual boiling-condensing mechanism. This permits extraction of substances that may be affected by heat and prevents any rise in temp. of the material extracted, which may cause secondary changes. C. J. C. B.

Vacuum regulator. J. C. Macsween (*J. Path. Bact.*, 1943, 54, 107—109). C. J. C. B.

Accurate high-sensitivity apiezon oil McLeod gauge. J. Bannon (*Rev. Sci. Instr.*, 1943, 14, 77; cf. A., 1943, I, 139).—Erratum. L. J. J.

Report on recommended specifications for microchemical apparatus. Sulphur and halogens. G. L. Royer, H. K. Alber, L. T. Hallett, and J. A. Kuck (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 230—234; cf. A., 1941, II, 385).—Drawings of apparatus, with dimensions, are given. L. S. T.

Pressure stopcock. J. A. Connelly (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 200). L. S. T.

Rolling ball viscometer. R. M. Hubbard and G. G. Brown (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 212—218).—An investigation of the inclined tube and rolling ball as applied to the measurement of η . General relationships between the variables involved and the calibration for the rolling ball viscometer in the streamline region of fluid flow are derived. L. S. T.

[Portable] gas generator. S. Katz (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 161). L. S. T.

Semi-micro-Kjeldahl apparatus. B. T. Dewey and N. F. Witt (*J. Amer. Pharm. Assoc.*, 1943, 32, 55—56).—The apparatus is constructed so that distillation takes place from the flask in which the digestion has been carried out. J. E. P.

Absorption tube for investigation of gases at low pressures. P. A. Leighton and D. H. Volman (*J. Opt. Soc. Amer.*, 1943, 33, 79—80).—A long Pyrex glass absorption vessel and high-intensity arc source for absorption spectroscopy at low pressures are described. L. J. J.

Displacement development in adsorption analysis. A. Tiselius (*Arkiv Kemi, Min., Geol.*, 1943, 16, A, No. 18, 11 pp.).—It is shown that chromatographic adsorption bands should not traverse a column uniformly because of the dependence of adsorption coeff. on concn., especially at low concns. The resultant "tailing" of bands is avoided by developing with a substance which is more strongly adsorbed than those being separated; in effect adsorption throughout each zone then takes place from a solution of uniform concn. The application to the separation of sucrose from glucose on C using PhOH as developer and examining eluates interferometrically is described. A. H. C.

Determination of velocity of sound by the employment of closed resonators and the hot-wire microphone. W. S. Tucker (*Phil. Mag.*, 1943, [vii], 34, 217—235).—A modified double Helmholtz resonator, the response of which is measured by the change of resistance of a hot wire in the neck, is described. Vals. obtained for velocity of sound in air, H_2O vapour, Et_2O vapour, and $COMe_2$ vapour from response-frequency curves agree with existing data, and confirm a linear relation between velocity and resonance-frequency. L. J. J.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Graphic representation of ionic radii. T. Moeller (*J. Chem. Educ.*, 1942, 19, 428). L. S. T.

Mathematical expression and interpretation of scientific measurements. W. W. Razim (*J. Chem. Educ.*, 1942, 19, 411—414).—A condensation of the theory of errors and related topics to a form serviceable in the laboratory. L. S. T.

Ludwig Gattermann. R. E. Oesper (*J. Chem. Educ.*, 1942, 19, 444—445). L. S. T.

William Murdoch. W. Cullen (*Chem. and Ind.*, 1943, 201—203).

Ross Aiken Gortner. 1885—1942. C. H. Bailey (*Cereal Chem.*, 1943, 20, 1—2). N. L. K.

XIII.—GEOCHEMISTRY.

Geochemistry of the atmosphere and constitution of terrestrial planets. R. Wildt (*Rev. Mod. Physics*, 1942, 14, 151—159).—The

compositions of the atm. of the earth, Venus, Mercury, Mars, and the Moon are reviewed. Geochemical aspects of planetary evolution and the chemical differentiation of the above planets are also considered. A. J. M.

Discovery of deposits of sodium sulphate at Didwana [Jodhpur]. H. B. Dunncliff (*Current Sci.*, 1943, 12, 7—12).—The discovery and utilisation of $NaCl$ and $Na_2SO_4 \cdot 10H_2O$ in these deposits are discussed. W. R. A.

X-Ray study of monetites.—See A., 1943, I, 145.

American synthetic emerald. A. F. Rogers and F. J. Sperisen (*Amer. Min.*, 1942, 27, 762—768).—Results of a microscopical and chemical examination of emeralds synthesised by C. F. Chatham are described. The synthetic emerald, ρ_{obs} 2.667, is of good quality, and approaches in colour the better grades of Colombian emeralds. The synthetic can be distinguished from the natural product by the character of its inclusions. A chemical analysis is given. L. S. T.

Minor chemical elements in fluorites from Jamestown, Colorado. J. M. Bray (*Amer. Min.*, 1942, 27, 769—775).—Spectrographic analyses of four fluorites (I) showed the presence of 20 minor elements, the most abundant of which are Sr, Ba, Fe, Y, Cu, Mg, Al, and Si. These probably substitute for Ca in the ionic fluorite structure. The oldest and the most fine-grained (I) was the most impure, and the youngest, from a pyritic Au-vein, the purest. Correlation between minor elements present and geological environment, but not radioactivity, fluorescence, or type of wall rock, is established. L. S. T.

Spectrographic data concerning the presence of the less common elements in rocks. G. O. Freeman (*Amer. Min.*, 1942, 27, 776—779).—Results obtained in the spectrographic analysis of 425 miscellaneous samples of rocks are classified and discussed. Y was found in a sample consisting of 50% fluorite and 40% quartz, Te in a sample of sand that contained Au and Bi, Ge in a sample of a mixture of pyrite and quartz which also contained Pb, As, Zn, and Cd, and Nb in a large crystal of orthoclase. L. S. T.

Potash-oligoclase in Hawaiian lavas. G. A. Macdonald (*Amer. Min.*, 1942, 27, 793—800).—Interstitial feldspar in these lavas with the n of oligoclase or andesine has an abnormally small positive optical angle. This is due, not to admixture with nepheline or carnegieite, but to potash feldspar. Numerous chemical analyses of the lavas are recorded. L. S. T.

New data on thortveitite. J. P. Marble and (Miss) J. J. Glass (*Amer. Min.*, 1942, 27, 696—698).—Thortveitite (I) from Eptevann, Iveland District, S. Norway, has hardness 6—7, ρ 3.58, α 1.751, β 1.789, γ 1.803, SiO_2 45.79, CaO 0.24, MgO 0.17, MnO 0.53, ThO_2 0.09, Sc_2O_3 34.32, La_2O_3 etc. 1.48, Y_2O_3 etc. 9.52, Fe_2O_3 2.95, Al_2O_3 4.95, TiO_2 <0.01; U_3O_8 , Pb, and ZrO_2 0.00, H_2O —0.07, H_2O_{110} 0.00, total 100.11%. (I) is very refractory. L. S. T.

X-Ray evidence of the existence of the mineral digenite, Cu_3S_8 . N. W. Buerger (*Amer. Min.*, 1942, 27, 712—716).—X-Ray investigation of the system Cu_2S — CuS shows the existence of the compound Cu_3S_8 , the diffraction pattern of which corresponds with that of a type specimen of digenite. This mineral is the same as "isometric chalcocite," or "blue chalcocite," and must be re-established as a mineral species. L. S. T.

Inter-trappean beds at Upparhatti [Belgaum District]. K. V. Kelkar and R. B. Gupte (*J. Univ. Bombay*, 1943, 11, A, Part 5, 121—125).—The red sandy marl, containing up to 10% of $CaCO_3$ as calcite and fine calcareous dust, and its accessory constituents are described. L. S. T.

Dharwar rocks occurring around Murgod in Belgaum District. L. V. Agashe (*J. Univ. Bombay*, 1943, 11, A, Part 5, 126—137).—The epidiorite and the argillite groups of rocks, the banded haematite-quartzites, and the marbles and chloritic marbles are described, and their origin is discussed. Chemical analyses are recorded. L. S. T.

Caliche deposits on Southern High Plains, Texas. R. Sidwell (*Amer. J. Sci.*, 1943, 241, 257—261).—These deposits overlie Tertiary sediments; they are 42—68 ft. thick, and consist mainly of $CaCO_3$, SiO_2 , clay minerals, and volcanic ash. Sol. carbonates vary from small amounts to 90% of the deposit. Insol. materials consist of SiO_2 nodules and lenses, some heavy minerals, clay minerals, quartz grains, and nearly pure beds of volcanic ash. Most of the caliche sediments, except SiO_2 , suggest Aeolian origin. The SiO_2 is probably secondary. L. S. T.

Merwinite in the system CaO — MgO — SiO_2 . T. W. Parker and R. W. Nurse (*Iron and Steel Inst.*, May 1943, *Advance copy*, 12 pp.).—The primary phase field of merwinite (I) in the system CaO — MgO — SiO_2 is established, and the position of the invariant points with the neighbouring fields of larnite, akermanite, monticellite, and periclase given. Pure (I) melts incongruently at 1590° , forming $2CaO \cdot SiO_2$ and liquid. Application of the data to the stabilisation of blast-furnace slags and of dolomite refractories is discussed. L. S. T.

A., I.—General, Physical, and Inorganic Chemistry

AUGUST, 1943.

I.—SUB-ATOMICS.

Identification of orders and ghosts in grating spectra.—See A., 1943, I, 186.

Spectrum of neutral tungsten, W I. O. Laporte and J. E. Mack (*Physical Rev.*, 1943, [ii], 63, 246—297).—An analysis yields 300 levels, and tentative *g* vals. are given to 201 of these. Configurations and *L* and *S* vals. are assigned to 65 levels, with 18 ambiguities due to a mixing of eigenfunctions. All the low levels are believed to be known. The ionisation potential is 7.94 ± 0.1 v. A rectangular array of the transitions and full data for ~ 2250 classified lines are given. N. M. B.

Quenching of cadmium resonance radiation (3261 Å.) by hydrocarbons and other gases. E. W. R. Steacie and D. J. LeRoy (*J. Chem. Physics*, 1943, 11, 164—171).—Measurements of quenching of the Cd resonance line 3261 Å. give the following quenching cross-sections: H_2 3.54, D_2 1.80, NH_3 0.052, C_2H_4 24.9, C_3H_6 29.1, $CH_2:CH_2$ 35.2, $(:CHMe)_2$ 30.6, C_6H_6 28.4, C_2H_2 22.0, cyclopropane 0.71, C_2H_6 , C_3H_8 , *n*- and *iso*- C_4H_{10} $\sim 0.02 \times 10^{-16}$ sq. cm. For the 2288 Å. line the quenching cross-sections for C_2H_4 , H_2 , and C_3H_8 are in the ratio $\sim 1:1:3$. L. J. J.

Light of the night sky. C. T. Elvey (*Rev. Mod. Physics*, 1942, 14, 140—150).—The general spectral features of the light of the night sky are reviewed. The strongest lines are at 5577.35, 6300, and 6364 Å. These are the only lines definitely assigned to radiation from atoms. Investigations in the infra-red are difficult to carry out and more determinations are needed. The chief lines found in the ultra-violet are discussed. In both non-polar and polar auroras the forbidden transitions of the O atom are found. The Na line is strong in the non-polar aurora, but is absent from the polar. Photometric observations are discussed. These observations on the strong lines in the red to green part of the spectrum give information concerning the height of the non-polar auroral layer, the nocturnal variations of intensity, and the geographical distribution of the intensity of various radiations. The distribution of light in the auroral layer is not uniform. The Na line in auroral light is very strong during twilight and fades rapidly to a const. intensity when the instrument faces west, but the reverse is the case when facing east. Magnetic effects are discussed, and the theoretical explanations of these observations are considered. A. J. M.

Theory of particles of spin half and the Compton effect. H. J. Bhabha and D. Basu (*Proc. Indian Acad. Sci.*, 1942, 15, A, 105—117).—Mathematical. W. R. A.

Centrifugation of electrons. H. Klarmann (*Naturwiss.*, 1942, 30, 424).— Cu_2O , Se, and TiO_2 -phenol resin barrier-layer rectifiers rotated at 450*g* on the circumference of a metallic disc showed no effect on the electron density at the boundary of the semi-conductor as indicated by the characteristic lines. L. J. J.

Energy loss by radiation of fast electrons in a Coulomb field. J. C. Jaeger (*Proc. Camb. Phil. Soc.*, 1943, 39, 127—130).—An exact solution of the problem of the energy loss by radiation of a fast electron in a Coulomb field is presented, relativistic Coulomb wave-functions being used. Except near the short- λ limit, the discrepancy between the cross-section deduced and that obtained by the Born approximation is not great. A. J. M.

Effect of high-frequency voltage on dielectric constant of space containing electrons. S. Ghosh (*Current Sci.*, 1943, 12, 53—54).—Investigation of the variation of thermionic current of a valve with high-frequency voltage indicates that there is no dependence of dielectric const. on high-frequency voltage, but the effect observed is secondary in nature. A. J. M.

Small-angle scattering of electrons by aluminium. B. C. Dees and B. Hamermesh (*Physical Rev.*, 1943, [ii], 63, 297—303).—The angular distribution of scattering of 46.4-e.kv. electrons by Al foil 1.3×10^{-5} cm. thick was investigated in the angular range $0-10^\circ$. The vals. of the mean projected scattering angle accord with theory (cf. Goudsmit, A., 1940, I, 336). The observed scattering is mainly of plural type. N. M. B.

Proposed physico-chemical unit, g./N, to be called a "Cannizzaro unit." U. Sborgi (*Gazzetta*, 1942, 72, 293—297).—Arguments are presented for the adoption of a "Cannizzaro unit," 1 g./N (g. =

mass or wt.; *N* = Avogadro no.), so that 1 Cannizzaro (1.6606×10^{-24} g.) = the wt. or mass of the atom of an ideal element of which 1 g.-atom has the wt. or mass of 1 g. At. wts. would then be expressed in Cannizzaro units. E. W. W.

Average H-H₂ repulsive potential from collision cross-section measurements. I. Amdur (*J. Chem. Physics*, 1943, 11, 157—159).—Agreement with Amdur and Pearlman's results (A., 1940, I, 89) for elastic collision cross-sections between H at 200—800 v. and H₂ at room temp. is given by the repulsive potential function $V(r) = [0.846e^{-24.9r^2} + 0.211e^{-2.40r^2}] \times 10^{-10}$ erg (*r* in Å.). L. J. J.

Radioactive isotopes of mercury. G. Friedlander and C. S. Wu (*Physical Rev.*, 1943, [ii], 63, 227—234).—A detailed account of results previously reported (cf. A., 1942, I, 128). N. M. B.

Nuclear energy levels in ⁵⁶Fe from the decay of ⁵⁶Mn and ⁵⁶Co. L. G. Elliott and M. Deutsch (*Physical Rev.*, 1943, [ii], 63, 321—322).—A study of the photo-electrons produced in Pb by the γ -rays from ⁵⁶Mn confirms γ -rays of energy 0.845 ± 0.015 and 2.13 ± 0.05 Me.v., and shows an additional γ -ray of energy 1.81 ± 0.04 Me.v. A consistent disintegration scheme is presented. ⁵⁶Co emits γ -rays of energies 0.845 ± 0.015 (identical with that from ⁵⁶Mn), 1.24 ± 0.04 , and 3.4 ± 0.2 Me.v., and others of lower abundance in the range 1.5—3 Me.v. The max. positron energy is 1.50 ± 0.05 Me.v., and each positron is accompanied by a 1.24- and a 0.845-Me.v. γ -ray in cascade. If ⁵⁶Fe = 55.9572, then ⁵⁶Mn = 55.9612 and ⁵⁶Co = 55.9621. The threshold for a (*p*, *n*) reaction on ⁵⁶Fe should be 5.5 Me.v. N. M. B.

Nuclear energy levels. K. M. Guggenheimer (*Proc. Roy. Soc.*, 1942, A, 181, 169—182).—The formula for the energy levels of the rigid rotator has been applied to nuclei. The existence of simple rational relations between excitation levels of a nucleus, predicted by the rotator formula and empirically known in some heavy nuclei, has been confirmed in other nuclei. The vals. of the nuclear radii deduced are in conformity with vals. found by other methods. G. D. P.

Strong coupling mesotron theory of nuclear forces. R. Serber and S. M. Dancoff (*Physical Rev.*, 1943, [ii], 63, 143—161).—Mathematical. In the theory developed, based on the assumption that interaction between a nuclear particle and the mesotron field is strong, the two types of mesotron field, charged scalar and neutral pseudoscalar, are considered. Results for the latter, for large enough separation, are of the type obtained from perturbation theory. At closer approach the forces become ordinary (non-spin-dependent). Spin-dependent forces extending to small separations and of sufficient strength to account for the properties of the deuteron cannot be obtained. N. M. B.

Time distribution of cosmic rays. V. Sarabhai (*Proc. Indian Acad. Sci.*, 1942, 15, A, 89—104).—Arrival of cosmic rays on Geiger counter arrangements follows a law predictable from complete time randomness. Their behaviour is similar to that of radiations from radioactive sources. W. R. A.

Cloud-chamber and counter studies of cosmic rays underground. V. C. Wilson and D. J. Hughes (*Physical Rev.*, 1943, [ii], 63, 161—171; cf. A., 1939, I, 175).—Measurements with a counter-controlled cloud chamber and two counter coincidence sets in a mine at depths of 71, 141, 582, and 657 m. H₂O-equiv. are easily interpreted if it is assumed that underground the primary rays are mesotrons, and the soft rays and showers are electronic secondaries produced by the penetrating mesotrons. N. M. B.

Cosmic-ray stars at 10,000 feet. W. E. Hazen (*Physical Rev.*, 1943, [ii], 63, 213—214).—A preliminary survey of 8500 photographs with a cylindrical cloud chamber containing eight 0.7-cm. Pb plates separated by 2.5-cm. air spaces showed 58 stars, two originating in the gas and 56 in the Pb plates. The no. of penetrating particles was $\sim 19,000$. Results are discussed with reference to available data. N. M. B.

Nature of the primary particles responsible for cosmic-ray phenomena. W. F. G. Swann (*Physical Rev.*, 1943, [ii], 63, 210—211; cf. A., 1942, I, 36).—Mathematical. Conditions are satisfied by a primary particle of proton mass and single electronic charge splitting into 10 mesotrons. Intensity-zenith angle considerations indicate that there may be two types of primaries: protons responsible

for the generation of mesotrons at sea level and at medium altitudes, and heavier particles, possibly singly ionised He atoms, resulting through their offspring electrons in the special features of the broad intensity–zenith angle curves for high altitudes. N. M. B.

Atom-annihilation hypothesis as to the origin of the cosmic rays. R. A. Millikan, H. V. Neher, and W. H. Pickering (*Physical Rev.*, 1943, [ii], **63**, 234–245).—Tests over wide latitudes confirm the successive incidence of bands of rays due to annihilation of Si, O, N, C, and He atoms. There is further evidence for the transformation of the complete rest-mass energy of an atom into an electron pair (cf. A., 1942, I, 287). N. M. B.

Stability of principal periodic orbits in the theory of primary cosmic rays. J. Lifshitz (*J. Math. Phys. Mass. Inst. Tech.*, 1942, **21**, 284–292).—Mathematical. N. M. B.

II.—MOLECULAR STRUCTURE.

Vibration-rotation energies of the linear X–Y–Z type molecule. A. H. Nielsen (*J. Chem. Physics*, 1943, **11**, 160–163).—Mathematical. Nielsen's method (A., 1942, I, 131) is used and expressions for the XY_2 type mol. are derived from the results. L. J. J.

Convergence limit in C_2 spectrum. L. Gerö and R. Schmid (*Naturwiss.*, 1942, **30**, 420).—The convergence limit of the C_2 ${}^1\Pi \rightarrow {}^1\Pi$ system at 35,900 cm^{-1} above the lower ${}^1\Pi$ state, reported by Herzberg and Sutton (A., 1940, I, 281), is a spurious effect produced by extensive homogeneous perturbations of the upper ${}^1\Pi$ term in the higher vibration states, giving smaller rotational and vibrational consts. L. J. J.

Thermal excitation of pure band-emission. A. Gatterer (*Naturwiss.*, 1942, **30**, 421).—A pure band spectrum free from at. lines can be obtained by saturating a short C cylinder ~ 5 mm. in diameter with a test salt solution, drying, and passing a current of 200–300 A. The portions of the flame produced most remote from the C are the purest. Very complete band spectra of all the rare earth elements, including Ho, Er, Tu, and Yb, have been obtained. L. J. J.

Flame spectra in the photographic infra-red. A. G. Gaydon (*Proc. Roy. Soc.*, 1942, **A**, **181**, 197–209).—Spectra of flames of H_2 , CH_4 , and CO burning with O_2 and NO have been photographed in the region 6000 to 10,000 Å. All flames in which H_2O is a final product show a system of emission bands from the red to the far infra-red which are shown to be due to the vibration-rotation spectrum of H_2O . The top of a flame of O_2 burning in H_2 is coloured red by the emission of these bands. The strength of these bands in the flame of moist CO indicates that the excitation is a result of the combustion process. In the H_2 –NO flame new band structure in the infra-red is assigned to an extension of the NH_3 α -band. The CH_4 –NO flame also shows the NH_3 α -band and strong emission of the red system of CN. G. D. P.

Infra-red and Raman spectra of polyatomic molecules. XIX. Acetaldehyde and tetradeuteroacetaldehyde. J. C. Morris (*J. Chem. Physics*, 1943, **11**, 230–235).—Data between λ 3 μ . and 25 μ . are recorded and analysed. Vals. are assigned to 6 fundamental stretching, 5 bending, and 3 rocking frequencies, and to the restricted internal rotation. The barrier restricting internal rotation is calc. as ~ 2100 g.-cal. L. J. J.

Ultra-violet absorption spectra of tagetone and related ketones. T. G. H. Jones and F. N. Lahey (*Univ. Queensland Papers, Dept. Chem.*, 1942, **1**, No. 22, 3 pp.).—Woodward's rules (A., 1941, II, 197; cf. Evans *et al.*, A., 1942, I, 81) are extended to compounds containing $C:C:C:C:CO$. The second $C:C$ in $C:C:CO:C:C$ has no effect. Absorption spectra are recorded for tagetone [max. at 269 (ϵ 20,000) and 344 $m\mu$. (ϵ 105)], crotonylideneacetone ($\Delta^{\gamma\epsilon}$ - n -heptadien- β -one) [max. at 273 (ϵ 16,800) and 340 $m\mu$. (ϵ 123)], ψ -ionone [max. at 294 $m\mu$. (ϵ 24,500)], $\beta\zeta$ -dimethyl- Δ^{η} - n -octen- δ -one [max. at 280 $m\mu$. (ϵ 70) and in the far ultra-violet], and $\beta\zeta$ -dimethyl- n -octan- δ -one [max. at 285.5 $m\mu$. (ϵ 60)]. R. S. C.

Spectrographic study of evodionol and its derivatives. F. N. Lahey (*Univ. Queensland Papers, Dept. Chem.*, 1942, **1**, No. 21, 7 pp.).—Absorption spectra are detailed for evodionol (I) and its derivatives (cf. A., 1943, II, 241). They confirm conclusions of Morton *et al.* (A., 1940, I, 402) for the rottlerin (II) series and support the structures suggested for these substances. Figures below refer to absorption max. in EtOH. Substitution of COMe at $C_{(6)}$ of 5:7-dihydroxy-2:2-dimethylchroman (III) has the same effect as at $C_{(8)}$: cf. the $C_{(6)}$ -COMe derivative of (III) ~ 345 (ϵ 3250) and 293 $m\mu$. (ϵ 21,000). Methylation of one, and still more of both, OH vicinal to COMe depresses ϵ and slightly displaces the max. to shorter λ : cf. the 5-Me (dihydroevodionol) (IV) ~ 333 (ϵ 3750) and 288 $m\mu$. (ϵ 15,600), 7-Me ~ 332 (ϵ 3400) and 292 $m\mu$. (ϵ 18,400), and 5:7-Me₂ ether (dihydromethylevodionol) (V) of (III) 273 $m\mu$. (ϵ 6700). Replacement of the chroman by a 1:2-benzpyran nucleus causes a new, very intense band at ~ 262 $m\mu$. and slight displacement of other bands: e.g., (I) 350 (ϵ 4000), ~ 294 (ϵ 9000), and 262 $m\mu$. (ϵ 44,000) and its Me ether (VI) ~ 306 (ϵ 5100) and 256 $m\mu$. (ϵ 17,400); cf. (IV) and (V).

Replacement of COMe by $CO\cdot CH:CHPh$ greatly alters the absorption: e.g., the $CHPh$ derivative of (I) 389 (ϵ 10,900), 312 (ϵ 25,800), and 281 $m\mu$. (ϵ 24,200), of (IV) ~ 386 (ϵ 8750) and 333 $m\mu$. (ϵ 21,300), of (VI) 362 (ϵ 4000) and 290 $m\mu$. (ϵ 27,000), and of (V) 292 $m\mu$. (ϵ 10,700). Fusion of a chroman and pyran ring has little effect: e.g., 5-methoxy-8:8-dimethyl-1:2-pyrano[3:2- g]flavanone 345 (ϵ 4000), 290 (weak) (ϵ 11,500), and 261 $m\mu$. (ϵ 37,000), and its 6:7- H_2 -derivative 341 (ϵ 3000) and 288 $m\mu$. (ϵ 18,500). The data of Morton *et al.* (*loc. cit.*) for (II) were probably for a solution in hexane; in hexane a new max. is found at 400 $m\mu$.; in EtOH this is located at 415 $m\mu$. (ϵ 17,600) and the max. at 294 and 350 $m\mu$. are replaced by one at 300 $m\mu$. (ϵ 38,400). Absorption in the (I) series is the same in hexane as in EtOH. R. S. C.

$\alpha\beta$ -Unsaturated amino-ketones. IX. Colour and constitution.—See A., 1943, II, 232.

Absorption and resonance in dyes. L. G. S. Brooker (*Rev. Mod. Physics*, 1942, **14**, 275–293).—General views on the relation of colour to chemical constitution are first reviewed. The vinylenic shift, and the relation between it and degeneracy of the extreme resonance structures, are discussed from comparison of absorption curves of the cyanines and the corresponding anhydro-bases. The deviation in the absorption max. of unsymmetrical cyanines, its variation with chain length, and its relationship to the vinylenic shift are considered. Since the deviation depends on the relative basic strengths of the two terminal groups it is possible to arrange heterocyclic nuclei in order of basicity from measurements of the deviation. The deviations of unsymmetrical carbocyanines are also considered. The presence of a C_6H_6 ring in the conjugated chain causes suppression of degeneracy, and another method of obtaining the relative basic powers of heterocyclic nuclei is based on this fact. The results of the two methods show good agreement. The basic power of nuclei is largely due to additional resonance stabilisation. Dyes may be classified according to the degeneracy of the extreme resonance structures. Reasons why symmetrical cyanines derived from different heterocyclic nuclei absorb at different $\lambda\lambda$, even when the length of chain is the same, are advanced. Additional double bond stabilisation is a factor which contributes to the stability of dipolar structures in dyes. A. J. M.

Effects of environment and aggregation on the absorption spectra of dyes. S. E. Sheppard (*Rev. Mod. Physics*, 1942, **14**, 303–340).—The effect of the solvent on the absorption spectra of merocyanine and 1:4-diaminoanthraquinone is discussed with regard to the polar nature of the solvent and its acidity or basicity. Both non-polar and polar solvents displace λ_{max} to longer $\lambda\lambda$. Ionised cyanines are also considered. The aggregation of dyes in aq. solution is discussed; it has been found that examination of absorption curves does not reveal the degree of association. Electrochemical methods give the average order of association. The nature of the aggregate in H_2O is discussed. Steric hindrance supports the dimerisation theory to some extent. It is probable that a H_2O mol. participates in the structure of the aggregate, possibly being centrally co-ordinated between two cyanine cations. It is considered that dimeride formation accounts for the spectral deviations. The phthalocyanines show similar behaviour. The adsorption of acid dyes to Ag halides is considered, with reference to optical sensitisation. There appears to be a resonance stabilisation of the adsorbed dye as compared with the dissolved dye mol. In an adsorbed monolayer dimerisation probably occurs. The existence of mesophases is discussed. Heteropolymerisation in the mesophase and the heat of mesophase formation are considered. The spectra of crystallising dyes and of liquid dyes are dealt with. A. J. M.

Colour and constitution of polymethine dyes. K. F. Herzfeld and A. L. Sklar (*Rev. Mod. Physics*, 1942, **14**, 294–302).—Theoretical. The connexion between colour and constitution of polymethine dyes is discussed on the basis of the Heitler–London–Slater–Pauling valency bond method. Both symmetrical and unsymmetrical ions are considered. A. J. M.

Absorption spectra of carotenoids.—See A., 1943, III, 517.

Quantum yield of diacetyl fluorescence. G. M. Almy and P. R. Gillette (*J. Chem. Physics*, 1943, **11**, 188–195).—A quantum yield of 0.145 ± 0.03 , which is independent of pressure, has been found with exciting $\lambda\lambda$ 4047 and 4358 Å. λ 3650 Å. gives a quantum yield varying with pressure from 0 at zero pressure to nearly the above val. at 5 cm. The pressure effect is ascribed to predissociation at a level between those reached in excitation by λ 3650 and λ 4047 Å. L. J. J.

Raman effect. CXI. Saturated heterocyclic compounds. K. W. F. Kohlrusch and A. W. Reitz (*Z. physikal. Chem.*, 1940, **B**, **45**, 249–271).—Raman spectra are given for $(CH_2S)_3$, pyrrolidine, N -methyl-, -ethyl-, and -phenyl-pyrrolidine, $(CH_2)_4NH$, $[CH_2]_3O$, and $[CH_2]_4O$. Polarisation data are also given for the last four compounds. Symmetry classes and the influences of bonding on characteristic vibration $\nu\nu$ are discussed. W. R. A.

Raman spectrum and molecular vibrations of nitric and mono-deuteronitric acids. O. Redlich and L. E. Nielsen (*J. Amer. Chem. Soc.*, 1943, **65**, 654–660).— DNO_3 was prepared by adding D_2O to

N_2O_5 and has μ^{25} 1.5228, μ^{35} 1.3909 (HNO_3 , 1.3920). Raman spectra of HNO_3 and DNO_3 are given and compared. All nine fundamental ν were found in both spectra and are in accord with the isotopic product rule formula applied to a plane configuration of symmetry C_s . W. R. A.

Raman spectra of hydrocarbons. II. β -Methyl- Δ^2 -heptene and γ -methyl- Δ^2 -heptene. F. F. Cleveland (*J. Chem. Physics*, 1943, 11, 227—230; cf. A., 1943, I, 116).—Raman frequencies, intensities, and depolarisation factors are recorded. L. J. J.

Raman effect and hydrogen bonds. VIII. Solutions of coumarin in mineral acids. G. V. L. N. Murty and T. R. Seshadri (*Proc. Indian Acad. Sci.*, 1943, 17, A, 55—57).—Solutions of coumarin in mineral acids give the Raman C=O frequency at lower wave no.; this is attributed to formation of complexes by means of H bonds. W. R. A.

Molar polarisations in extremely dilute solutions. R. Davis, H. S. Bridge, and W. J. Svirbely (*J. Amer. Chem. Soc.*, 1943, 65, 857—862).—Dipole moments of 8 org. compounds have been determined in C_2H_6 or dioxan. Abnormal behaviour of P_2/N_2 curves in very dil. solutions is due to experimental errors, the nature of the abnormality depending on the sign of error in P_1 . W. R. A.

Dielectric dispersion and absorption of water and organic liquids. W. P. Connor and C. P. Smyth (*J. Amer. Chem. Soc.*, 1943, 65, 382—389).—Dielectric const. and absorption of H_2O (0—100°) and 16 org. liquids (25°) were measured using λ 9.72 cm. η of the org. liquids are given. The relaxation time of the mol. was calc. from the absorption and used to calculate ΔG , ΔH , and ΔS of activation of rotation of H_2O on the abs. reaction rate theory. The vals. obtained are comparable with those calc. from viscous flow. Polarisation of H_2O is due to mol. orientation, not to proton transfer. Relaxation times of org. mols. increase with size and deviation from spherical form, and are related to viscous flow of the liquid. W. R. A.

Influence of hindered molecular rotation on dielectric constants of water, alcohols, and other polar liquids. G. Oster and J. G. Kirkwood (*J. Chem. Physics*, 1943, 11, 175—178).—The authors' general theory of dielectric polarisation of polar liquids (A., 1940, I, 10) is applied to H_2O and aliphatic alcohols. A function (g), which measures the orientational correlation between neighbours in a liquid, is derived from quasi-rigid co-ordination models. Vals. calc. from the theory for ϵ of H_2O agree with observed vals. at 25° and differ by ~13% at 83°. With alcohols agreement is less close. Vals. are calc. for g for a no. of other polar liquids; g is related to thermodynamic abnormality. L. J. J.

Dipole moment and molecular structure. V. Dipole moments of derivatives of ethylene glycol and glycerides. S. D. Gokhale, N. L. Phalnikar, and S. D. Bhawe (*J. Univ. Bombay*, 1943, 11, A, Part 5, 56—62).—Dipole moments in C_2H_6 solution are recorded for $\text{OH}(\text{CH}_2)_n\text{OMe}$ (2.20), $\text{OH}(\text{CH}_2)_n\text{OEt}$ (2.22), $\text{OH}(\text{CH}_2)_n\text{OAc}$ (2.34), $(\text{CH}_2)_n\text{OAc}$ (2.32), $\text{OAc}(\text{CH}_2)_n\text{OMe}$ (2.13), $\text{OAc}(\text{CH}_2)_n\text{OEt}$ (2.25), $\text{C}_{12}\text{H}_{25}\text{COO}(\text{CH}_2)_n\text{OMe}$ (2.08), $\text{C}_{12}\text{H}_{25}\text{COO}(\text{CH}_2)_n\text{OEt}$ (2.02), $\text{C}_{12}\text{H}_{25}\text{COO}(\text{CH}_2)_n\text{OAc}$ (2.13), $(\text{C}_{12}\text{H}_{25}\text{COO})_2\text{CH}_2$ (2.30), $(\text{C}_{12}\text{H}_{25}\text{COO})_2\text{CH}_2$ (2.26), monostearin (3.04), monomyristin (2.99), $(\text{CH}_3\text{CO}_2\text{Et})_2$ (2.38 D.). The results are in accordance with the views of Clarkson and Malkin (A., 1934, 720) on the structure of the triglycerides. F. R. G.

Electric moments of σ -substituted phenols and anisoles. I. Halogen derivatives. W. F. Anzilotti and B. C. Curran (*J. Amer. Chem. Soc.*, 1943, 65, 607—611).—Vals. of μ for σ -fluoro-, -chloro-, and -bromo-anisole and for σ - $\text{C}_6\text{H}_4\text{ClOEt}$ in C_2H_6 suggest that the double-bond character of the ring-to-O bond is sufficient to lock these mols. in a *trans*-configuration. In CCl_4 the vals. of μ for σ -fluoro-, -chloro-, and -bromo-phenol show that 85—90% of the mols. have the OH in the *cis*-position, owing to intramol. H bonding. Vals. of μ for dioxan solutions are > those for C_2H_6 or CCl_4 , and it is suggested that dioxan forms H bonds with *trans*-mols. and upsets the *cis-trans* equilibrium. The order of bond strengths in the phenols is $\text{H}\cdots\text{F} > \text{H}\cdots\text{Cl} > \text{H}\cdots\text{Br}$. W. R. A.

Quantisation of molecules, inter- and intra-molecular forces. K. Fajans and T. Berlin (*Physical Rev.*, 1943, [II], 63, 309—312, 399; cf. A., 1943, I, 81).—The quantisation of the electrons of the at. cores and of the valency electrons is distinguished. The latter can be quantised with respect to the field of both cores (shared electrons) and to the field of single cores (unshared electrons). Consequences are discussed. N. M. B.

Donor-acceptor bonding. I. Etherates of boron trifluoride. A. W. Laubengayer and G. R. Finlay (*J. Amer. Chem. Soc.*, 1943, 65, 884—889).—Donor-acceptor bonding in $\text{Me}_2\text{O}\cdot\text{BF}_3$ (I), $\text{Et}_2\text{O}\cdot\text{BF}_3$ (II), and $\text{MeOEt}\cdot\text{BF}_3$ has been examined. Mol. vols. are < the combined mol. vols. of the ether and BF_3 . Saturated v.p. of the three etherates have been measured. Heats of formation of (I) and (II), and heats of dissolution of BF_3 and (I) in H_2O , and of BF_3 and (II) in Et_2O , have been determined calorimetrically. The heat of dissociation of (I) has been determined from v.d. measurements. Cryoscopic mol. wt. determinations in C_6H_6 indicate that the substances are monomeric in solution. Dipole

moment measurements in C_6H_6 show that the bond moment of B—O is small. W. R. A.

A. Stereochemistry of co-ordination number eight. L. E. Marchi, W. C. Fernelius, and J. P. McReynolds. (B. Optical activity of potassium tetra-oxalato-uranium-IV. L. E. Marchi and J. P. McReynolds (*J. Amer. Chem. Soc.*, 1943, 65, 329—333, 333—335).—(A) Isomeride tables of mono- and bi-dentate groups of compounds of co-ordination no. 8 are given for 4 different configurations.

(B) Four optically active isomerides of $\text{K}_4[\text{U}(\text{C}_2\text{O}_4)_4]$ have been found, two stable and two racemising easily. Cubic and trigonal prism configurations (with two extra bonds along the unique axis) are thus impossible for the compound, but the square Archimidean antiprism or the dodecahedron (triangular faces, symmetry V_d) are possible. W. R. A.

Structure of $\text{Mo}(\text{CN})_8^{4-}$. C. Racah (*J. Chem. Physics*, 1943, 11, 214).—It is shown that 8 equiv. non-cylindrical bond functions can be constructed by *s-p-d* hybridisation. The bond functions are in two sets making angles $34^\circ 33'$ and $72^\circ 47'$ with the z axis and having strengths 2.9954 and 2.9696, respectively. L. J. J.

Calculations of univalent ionic radii and ionic refractions. S. T. Li (*J. Chinese Chem. Soc.*, 1941, 8, 143—146; cf. A., 1941, I, 191).—Univalent ionic radii are calc. from the equation $R_i = k(0.32 + \pi/50)\pi^2 Z^{-1} r^{(1-\pi/50)}$, where Z is the at. no., z the valency, π the principal quantum no., and k is 1.44 for non-rare-gas type ions, and 1.00 for rare-gas type ions, whence $([R]/0.603)^{2/3} = k'R_i$, where $[R]$ is the ionic refraction and k' is 1 for non-rare-gas, and 1.19 for rare-gas type ions. Vals. of R_i and $[R]$ are tabulated and are comparable with those of other authors. F. R. G.

Structure of the protein molecule. D. G. Dervichian (*J. Chem. Physics*, 1943, 11, 236—246).—A two-dimensional double layer of NH_2 -acids is postulated as the constitution of proteins in solution. The shape and size of a protein mol. of mol. wt. ~3500 can be estimated from the size of a single NH_2 -acid residue. Denatured mols. may have a filamentous or fibrous form, characterised by the polypeptide chain. L. J. J.

III.—CRYSTAL STRUCTURE.

Diffraction of X-rays by thermal waves. K. Bleuler and J. Weigle (*Arch. Sci. phys. nat.*, 1942, [v], 24, Suppl., 210—212).—Mathematical. For a crystal consisting of similar atoms, a reflexion due to thermal waves cannot be obtained on a plane of zero structure factor. The atoms move rigidly under the effect of thermal waves. N. M. B.

Higher-order terms in the diffraction of X-rays by crystals. L. Bonnelance and K. Bleuler (*Arch. Sci. phys. nat.*, 1942, [v], 24, Suppl., 213—216; cf. preceding abstract).—Mathematical. The continuous supplementary electron density distribution due to thermal perturbation is calc. A diminution of thermal diffusion of X-rays with rise of temp. outside the Bragg angle is noted as a new effect influencing the interpretation of experimental results. N. M. B.

New concepts of the solid state. (Sir) C. V. Raman (*Proc. Indian Acad. Sci.*, 1942, 15, A, 65—72).—An address. W. R. A.

Crystallographic properties of electric furnace borosiluminates.—See B., 1943, I, 288.

Glass systems. X-Ray analysis of sodium chloride dissolved in boron trioxide glass. S. K. Majumdar and R. M. Palit (*J. Indian Chem. Soc.*, 1942, 19, 461—466).—The lattice distance of NaCl dissolved in B_2O_3 glass, determined by the Debye-Scherrer method, is 9.088 Å, which is 66% > the normal val. This discrepancy is discussed theoretically, and the increase is ascribed to the effect of the dielectric const. of the medium; this tends to decrease the Coulomb forces of attraction, but to leave the repulsive forces practically unaffected. A. J. M.

Structure of liquid carbon tetrachloride. A. Eisenstein (*Physical Rev.*, 1943, [II], 63, 304—308).—A Fourier analysis of corr. X-ray diffraction patterns obtained at 27° by photographic and Geiger-Müller counter methods gives the electron density distribution function for the liquid. C—Cl and Cl—Cl distances within the mol. are shown, and intermol. distances and concns. are indicated. The latent heat of vaporisation (6.24 kg.-cal. per g.-mol.) calc. from the distribution function is in fair agreement with experiment (7.09 kg.-cal. per g.-mol.). N. M. B.

Symmetry and physico-chemical properties of crystallised compounds. II. General structural principles of organic compounds. W. Nowacki (*Helv. Chim. Acta*, 1943, 26, 459—462; cf. A., 1942, I, 389).—Theoretical. The space-groups available to substances having mols. of a low degree of symmetry and weak intermol. forces are enumerated. F. J. G.

Diffraction of X-rays by sodium stearate at room temperature. J. W. McBain, A. de Bretteville, jun., and S. Ross (*J. Chem. Physics*, 1943, 11, 179—183).—Re-examination of the α -form of Na stearate examined by Thiessen and Stauff (A., 1936, 1186) gives X-ray data

in agreement (some earlier data are corr.). The present vals., a 8.03 ± 0.03 , b 9.22 ± 0.02 , c 52.1 ± 0.3 Å., give $\rho_{\text{calc.}}$ 1.052. The monoclinic β -form obtained by heating the α -form at $>54^\circ$ gives a 8.7, b 5.1, c sin β 46.6 Å., β 63° , b/a sin β 0.66, ρ 0.99 for 4 mols. per unit cell. Fusion and cooling gives a new (γ) form, with long spacing 44.6 Å. L. J. J.

Structure of *p*-dibromobenzene as determined by Fourier analysis. S. Bezzi and U. Croatto (*Gazzetta*, 1942, 72, 318—335).— p -C₆H₄Br₂ has been shown (Bezzi *et al.*, *Rend. Ist. Ven. Lett. Sci. Arti*, 1941—42, 101, ii, 237) to crystallise in space-group $C_{2h}^2-P2_1/a$, the unit cell containing 2 mols., and having a 15.36, b 5.75, c 4.10 Å., β $112^\circ 30'$. The parameters for Br (x_{Br} 0.168, y_{Br} 0.169, z_{Br} 0.974) obtained by Patterson projection are confirmed by Fourier projection on planes (001) and (010), which also gives the parameters for C₍₁₎, C₍₂₎, and C₍₃₎. The structure is represented perspectively. The distance Br—Br (same mol.) is 6.50 Å., the min. distance Br—Br (different mols.) 3.76 Å., and the distance between Br and linked C is 1.84 Å. E. W. W.

Fine structure of lignins. R. Jodl (*Brennstoff-Chem.*, 1942, 23, 163—169, 178—181).—X-Ray examination showed that cuproxam-lignin (I) crystallites are ~ 9 Å. high and ~ 16 Å. in diameter. Three layers 3.9 Å. apart are arranged one above the other in the crystallite. Lignin, like other humic substances, must be regarded as a lamellar disperse system. Lignin was found to have a d of 1.41; the H₂O vapour isotherms indicated that H₂O is bound both by lyosorption and by capillary condensation, as in humic substances. (I) contained 7 g. of lyosorption H₂O and 27 g. of capillary H₂O per 100 g. of dry lignin. Lignin represents a polycapillary system with pores 30—20,000 Å. in diameter; the surface area is ~ 180 sq. m. per g. The microscopical picture of a transverse or longitudinal section of wood cells indicates that the lignin and cellulose are interwoven in a structure finer than the λ of light. Lignin is not hydrophilic but is organophilic and cannot be regarded as a homogeneous compound of fixed mol. wt. R. B. C.

Donor-acceptor bonding. II. Electron diffraction of dimethyl ether-borane trifluoride. S. H. Bauer, G. R. Finlay, and A. W. Laubengayer (*J. Amer. Chem. Soc.*, 1943, 65, 889—895; cf. A., 1943, I, 193).—The best model of Me₂O·BF₃ has B valency angles tetrahedral and the ether portion unchanged, although the C—O distance may increase to 1.44 Å. B—F and B—O distances are 1.41 ± 0.02 and 1.52 ± 0.06 Å. Models having one or more O valency angles of 120° cannot be completely excluded. Energetics of the association suggest sharing of an electron pair, not dipole-dipole interaction, as the mechanism of bond formation. W. R. A.

Thermodynamics of crystal lattices. I. Discussion of the methods of calculation. M. Born. **II. Calculation of certain lattice sums occurring in thermodynamics.** M. Born and M. Bradburn. **III. Equation of state for a face-centred cubic lattice.** M. Bradburn (*Proc. Camb. Phil. Soc.*, 1943, 39, 100—103, 104—113, 113—127).—I. A discussion of the problems involved in the theoretical investigation of stability conditions of crystal lattices is given. The general method of attack of the problem in future papers is outlined.

II. A method of calculating lattice sums of the type required in discussing the stability of cubic crystals of the Bravais type, involving the phases of the waves, is developed. Tables of the lowest lattice sums have been computed.

III. The equation of state for the simplest stable crystal, the cubic face-centred lattice, is determined. The result is compared with those obtained using rough approximations in order to get an estimate of the degree of reliability of the latter. A. J. M.

Electronic energy bands in (A) body-centred iron. M. F. Manning. **(B) Face-centred iron.** J. B. Greene and M. F. Manning (*Physical Rev.*, 1943, [ii], 63, 190—202, 203—210).—(A) Calculations by the Wigner-Seitz-Slater method are reported. There are two filled and four partly filled bands; the two lowest filled bands are responsible for cohesion, the next three partly filled bands for ferromagnetism, and the highest band for electrical conduction. The width of the occupied levels is ~ 0.6 Rydberg. The density of states, calc. as a function of energy, is 17 at the highest occupied energy level, compared with 11.4 electrons per atom Rydberg for face-centred Fe, the higher val. accounting for the ferromagnetism of body-centred Fe, and also for the greater electronic sp. heat compared with face-centred Fe. This higher sp. heat is responsible for the high-temp. change from face-centred to body-centred structure.

(B) Similar calculations for face-centred Fe show two filled and four partly filled bands. The calc. density of states-energy curves closely resemble that for body-centred Fe. Results are used to calculate the average Fermi energy as a function of the total no. of valency electrons, to investigate the ferromagnetism of Ni and Co by calculating the change in Fermi energy as a function of the no. of uncompensated spins, and to calculate the electronic sp. heat at high temp. This val. agrees fairly well with the difference from 3R of the experimental sp. heat. N. M. B.

Structure of rolled and annealed aluminium as revealed by X-rays. E. E. Spillett (*J. Inst. Metals*, 1943, 69, 149—175).—The orientation developed in commercial Al sheet by cold-rolling from a hot-rolled

blank without intermediate annealing usually approximates to (112) fibring; an intermediate anneal gives a more uniform product by removing inhomogeneity derived from the earlier hot-roll. Recrystallisation of hard-rolled Al begins and ends in the surface layers at lower temp. than in the centre, but this effect is minimised by an intermediate anneal at 360° , which also reduces the recrystallisation temp. of the final product, whereas an intermediate anneal at 500° raises it. Commercial cold-rolled Al recrystallises with random orientation unless the Fe content is high, in which case the rolling orientation may persist after annealing. With Al of high purity annealing may produce preferential recrystallisation, accompanied by marked preferred orientation in which a cube face lies in the rolling plane and a cube edge in the rolling direction. The lattice spacing in hard-rolled Al strip varies throughout the thickness and in the final product is influenced by the temp. of any intermediate anneal; it increases during the mechanical softening which occurs before recrystallisation and decreases during the actual recrystallisation. A. R. P.

X-Ray study of the transformation of cobalt. O. S. Edwards and H. Lipson (*J. Inst. Metals*, 1943, 69, 177—188).—High-temp. X-ray photographs of pure Co powder and rod have been taken in an attempt to find the cubic-hexagonal transformation temp. Above 500° the cubic form is stable; powder remains cubic down to 300° , at which point some of the metal becomes hexagonal, but the amount so converted does not increase with time. As the temp. is further lowered more of the sample becomes hexagonal until at room temp. $\sim 5\%$ is converted; on raising the temp. no change occurs at $<500^\circ$, at which temp. all the sample becomes cubic. With rod, transformation begins on cooling at $\sim 400^\circ$ and the metal is almost completely hexagonal at 300° ; reversion to cubic again occurs fairly sharply at $\sim 500^\circ$. It is suggested that the free energies of the two forms of Co become almost equal just below 500° so that other factors must affect the approach to equilibrium. Increase in surface energy would account for the greater ease of transformation of the rod compared with the powder. A. R. P.

IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

Probable accuracy of the general physical constants. (A) F. Benford. (B) R. T. Birge (*Physical Rev.*, 1943, [ii], 63, 212, 213).—(A) The distinction between real accuracy and consistency of data in computing an assigned val. is emphasised and illustrated by tabulated consts.

(B) A discussion of (A).

N. M. B.

Mol. wt. of rubber.—See B., 1943, II, 230.

Mean mol. wt. of bitumens.—See B., 1943, I, 272.

Electrical conductivity of lead chromate. T. W. Lashof (*J. Chem. Physics*, 1943, 11, 196—202).—Sintered pellets of pure monoclinic PbCrO₄ have negligible contact resistance and obey Ohm's law over a wide range of voltage at temp. up to 700° . The conductivity (κ) varies with temp. by a Boltzmann-type law $\kappa \propto e^{-A/kT}$ where $A = 1.48$ e.v. at 350 — 700° and 0.60 e.v. at lower temp. k is also $\propto [O_2]^{-1/3.1}$. It is concluded that PbCrO₄ is an excess-electron semiconductor with $<1\%$ ionic conduction (Hall and Seebeck effect measurements) and activation energies 5.28 and 1.20 e.v. for the reactions $2\text{PbCrO}_4 \rightarrow \text{Pb}(\text{CrO}_2)_2 + \text{Pb} + 2\text{O}_2$ and $\text{Pb} \rightarrow \text{Pb}^+ + e$, respectively. L. J. J.

Effect of ionic radius and cation valency on electrical conductivity of silicate melts. K. Endell and J. Hellbrügge (*Naturwiss.*, 1942, 30, 421—422).—Measurements of viscosity (η) and sp. resistance (ρ) of silicate melts at 1250 — 1450° with 10—40 ion-% Li, Na, and K and with ~ 5 ion-% Li, Na, K; Be, Mg, Ca, Ba; B, Al, Fe, respectively, in Na₂O·2SiO₂ show that with increasing interlocking of SiO₄ tetrahedra η exceeds ρ by several orders of magnitude and increases more rapidly; when the SiO₄ network is broken down η and ρ are of the same order of magnitude. η^{-1} and ρ^{-1} increase with increasing ionic charge and decreasing Si:O ratio. ρ^{-1} increases and η^{-1} decreases with increasing cationic radius. L. J. J.

Magnetic susceptibility of the brown ferric phenanthroline complex. L. Michaelis and S. Granick (*J. Amer. Chem. Soc.*, 1943, 65, 481—482).—The effective magnetic moments of three preps. of

[phenan₂ Fe $\begin{smallmatrix} \text{OH} \\ \diagup \diagdown \\ \text{OH} \end{smallmatrix}$ Fe phenan₂]Cl₄ (phenan = *o*-phenanthroline) have been measured by a modified Gouy method in aq. solution and in the solid state. No indication of Fe-Fe interaction, as postulated by Gaines *et al.* (A., 1936, 1324), was observed. W. R. A.

Specific heats at low temperatures of magnesium ortho- and meta-silicate. K. K. Kelley (*J. Amer. Chem. Soc.*, 1943, 65, 339—341).—Sp. heats of Mg₂SiO₄ and MgSiO₃ have been measured at 51 — 298° K.; derived vals. of $S_{298.16}$ are 22.7 ± 0.2 and 16.2 ± 0.2 g.-cal. per degree per g.-mol., respectively. W. R. A.

Heat capacities and entropies of molybdenum and tungsten tri-oxides. H. Seltz, F. J. Dunkerley, and B. J. de Witt (*J. Amer. Chem. Soc.*, 1943, 65, 600—602).—Vals. of C_p for MoO₃ and WO₃,

have been determined calorimetrically at ~ 60 – 300°K . and yield entropy vals. of 18.68 ± 0.3 and 19.90 ± 0.2 g.-cal. per degree per g.-mol. at 298.1°K . ΔG equations of formation are derived.

W. R. A.

Heat capacity and entropy, heats of transition, fusion, and vaporisation, and v.p. of cyclopentane. Evidence for a non-planar structure. J. G. Aston, H. L. Fink, and S. C. Schumann (*J. Amer. Chem. Soc.*, 1943, **65**, 341–346).—Vals. of C_p for solid and liquid cyclopentane (I) have been determined calorimetrically at 11.8 – 293.82°K . The following data are given: transition temp., $122.39 \pm 0.05^\circ$ and $138.07 \pm 0.05^\circ$; m.p. $179.69 \pm 0.05^\circ$; b.p. $49.20 \pm 0.05^\circ \text{K}$; heats of transition 1165.1 ± 0.8 and 82.80 ± 0.08 ; heats of fusion and vaporisation 144.05 ± 0.30 and 6982 ± 8 g.-cal.; entropies of liquid and gaseous (I) at 298.16°K . are 48.87 ± 0.05 and 70.70 ± 0.07 g.-cal. per degree per g.-mol. from C_p data. Entropies for possible structures have been computed from spectroscopic data, and the best agreement with experimental data is given by the configuration C_5 (one C out of plane).

W. R. A.

Temperature of maximum density of heavy water. T. L. Chang and J. Y. Chien (*J. Chinese Chem. Soc.*, 1941, **8**, 74–75).—From pycnometric measurements on 99.54 mol.-% D_2O the temp. of max. d of pure D_2O is calc. as $11.21 \pm 0.05^\circ$.

J. W. S.

Statistical theory of liquids. II. G. Jaffé (*Physical Rev.*, 1943, [ii], **63**, 313–321; cf. A., 1943, I, 86).—A treatment of v.p., surface tension, and the neighbourhood of the crit. point. A discrepancy (suggesting association) is found between observed and calc. heats of vaporisation of 10 liquids, and also to a smaller extent for noble gases and monat. metal vapours. If a "molar surface S^* " is defined as a surface containing 1 g.-mol. of the liquid, the equation of state for the surface phase is $\gamma S^* = RT$. Eötvös' law follows as a limiting law for sufficiently high temp. For the neighbourhood of the crit. point the Cailletet–Mathias law is deduced, and the Kamerlingh Onnes const. is deduced from the special form of potential used in the theory.

N. M. B.

Vapour-liquid equilibria for hydrocarbons. C. D. Shiah (*J. Chinese Chem. Soc.*, 1941, **8**, 123–130).—A detailed account of work previously noted (B., 1942, I, 453). Since $\log K \approx a - b/T$ at const. pressure, it follows that within the limits of experimental error the temp. (T_1 and T_2) at which two substances have equal vapour-liquid equilibrium consts. (K) are related by $1/T_1 = a' + b'/T_2$. All the paraffins have a common val. of T_1 and of T_2 , and their mol. wt. is $\propto a'$, whence the data for high mol. wt. or mixed paraffins can be deduced.

F. R. G.

Distance correlations and Bose–Einstein condensation. F. London (*J. Chem. Physics*, 1943, **11**, 203–213).—The correlation effect on mol. distance distribution in a Bose–Einstein gas is calc. as a function of vol. and temp., particularly for condensation. The negative coeff. of thermal expansion of liquid He II may be related to the increased d as seen from a single mol. for certain condensed conditions.

L. J. J.

Pressure-volume-temperature relations of $\alpha\alpha\delta$ -trimethylpentane. W. A. Felsing and G. M. Watson (*J. Amer. Chem. Soc.*, 1943, **65**, 780–781).—Compressibility of liquid $(\text{CH}_3)_3\text{Pr}^\beta$ has been determined between 100° and 250° , and at pressures up to 300 atm. Vals. have also been obtained at 275° , above the crit. point.

W. R. A.

Viscosity of sulphur. R. F. Bacon and R. Fanelli (*J. Amer. Chem. Soc.*, 1943, **65**, 639–648).— η of pure S at various temp. was found to be independent of the method of purification and of the rate of heating or cooling. Preheating S, containing 0.038% of oil, to 260° gave very low vals. of η , which increased on maintaining the S at 160° . Crude H_2S_2 reduces η , and presumably causes the diminution by org. matter, NH_3 , amines, and H_2S . Halogens considerably reduce η ($\text{Cl} > \text{Br} > \text{I}$), the effect persisting for some time when halogenated S is heated in air at 200° . S containing a small amount of S halide or I is suggested as a heat-transfer liquid, because many metals are not attacked by it.

W. R. A.

Properties of liquid sulphur. R. E. Powell and H. Eyring (*J. Amer. Chem. Soc.*, 1943, **65**, 648–654).—Partial insolubility of chilled S_μ , and the relation between η and temp. for pure S, are quantitatively explained by a thermodynamical equilibrium between S_8 rings and S chains of all lengths. Reduction of η by halogens is deduced, and the pressure-variation of η predicted. Comparison with experiment supports the postulated chain-structure of S_μ .

W. R. A.

Mechanical properties of glass.—See B., 1943, I, 286.

Thermal diffusion with ammonia. W. W. Watson and D. Woernley (*Physical Rev.*, 1943, [ii], **63**, 181–184).—A "two-bulb" experiment with NH_3 containing $\sim 15\%$ ^{15}N to increase the accuracy of the mass spectrometer analyses shows that with decreasing temp. the thermal diffusion const. α of NH_3 changes from positive to negative vals. at about room temp. The val. of α is a linear function of $\log T$, and the rate of decrease is nearly 8 times that for Ne and Ar. In a qual. discussion the effect is attributed largely to the strong first-order dipole-dipole intermol. forces, which are $\propto 1/R^4$, where R = distance between interacting mols.

N. M. B.

V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

isoPropyl alcohol-water system. Density-composition data and pycnometric technique. W. M. Langdon and D. B. Keyes (*Ind. Eng. Chem.*, 1943, **35**, 459–464).—An improved pycnometric technique, requiring < 10 ml. of liquid, has been developed for determining the composition of alcohol- H_2O mixtures. The d in vac. of highly purified Pr^βOH is 0.77223 ± 0.00002 g. per ml. at 35° . d data for the system $\text{Pr}^\beta\text{OH}-\text{H}_2\text{O}$ at 35° are recorded.

C. R. H.

Total and partial pressures of binary mixtures of dioxan in benzene at 25° . P. C. Teague [with W. A. Felsing] (*J. Amer. Chem. Soc.*, 1943, **65**, 485–486).—Deviation from ideality is slight.

W. R. A.

Apparent ionic volume in infinitely dilute solutions. F. H. Lee (*J. Chinese Chem. Soc.*, 1942, **9**, 46–53).—The apparent ionic vol. in solution (v_s) and the spherical vol. of the ions in the cryst. state (v_c) are related by $v_s = av_c + b$. The parameters a and b are the same for all ions except Na^+ at const. temp. and increase with rising temp. The term av_c is regarded as an effective ionic vol. and b as a correction factor due to electrostriction of a unimol. H_2O layer around an ion.

J. W. S.

Apparent molal heat capacities of salts in infinitely dilute solutions. F. H. Lee and C. S. Sie (*J. Chinese Chem. Soc.*, 1942, **9**, 54–56).—The apparent mol. heat capacities (C_p) of alkali metal halides can be expressed: $C_p = a - b_c r_c - b_a r_a$, where r_c and r_a are the radii of the cation and anion respectively. For Na halides the val. of the const. a is anomalous. The parameters b_c and b_a are attributable to the restriction in motion of H_2O mols. around the ions.

J. W. S.

Diffusion of hydrogen and deuterium in palladium. II. W. Jost and A. Widmann (*Z. physikal. Chem.*, 1940, **B**, **45**, 285–296; cf. A., 1935, 1200).—Experimental technique and sources of error are discussed. The ratio of the diffusion coeffs. of H and D in Pd, which is $< \sqrt{2}$, is discussed in relation to the difference in the zero point energies of H and D in the Pd lattice.

W. R. A.

Precipitation in single crystals of silver-rich and copper-rich alloys of the silver-copper system. F. W. Jones, P. Leech, and C. Sykes (*Proc. Roy. Soc.*, 1942, **A**, **181**, 154–168).—The course of pptn. at different temp. in single crystals of the alloys was studied by X-ray diffraction methods. Pptn. is continuous at the higher temp. when the degree of supersaturation is low and discontinuous when the temp. is low and the supersaturation is high. The experimental results are considered in relation to theories of the pptn. process.

G. D. P.

Hall effect and physical constants of alloys. VII. Aluminium-silver series of alloys. H. Powell and E. J. Evans (*Phil. Mag.*, 1943, [vii], **34**, 145–161).—Measurements of ρ , sp. resistance, temp. coeff. of resistance, thermoelectric power, and Hall coeff. have been made on 18 annealed Ag-Al alloys, covering the whole composition range. The results are discussed in relation to the equilibrium diagram for the system; Petrenko's diagram (cf. A., 1905, ii, 635) is largely confirmed, but an additional phase boundary is detected at ~ 85 wt.-% Ag.

A. J. E. W.

Solubility product of barium chromate at various ionic strengths. G. L. Beyer and W. Rieman III (*J. Amer. Chem. Soc.*, 1943, **65**, 971–973).—The solubility product of BaCrO_4 at ionic strengths up to 0.25 has been determined and vals. agree well with the extended Debye-Hückel equation.

W. R. A.

Aqueous solubilities of r - and l -mandelic acids and three O -acyl- r -mandelic acids. W. R. Angus and R. P. Owen (*J.C.S.*, 1943, 231–232).—The aq. solubilities of r -mandelic acid (I) and of acetyl-, propionyl-, and benzoyl- r -mandelic acids over the range 0 – 50° and of l -mandelic acid (II) over the range 25 – 70° are recorded. The substituted acids and (II) are much less sol. than (I). The data fall into line with the solubilities of other geometrical and stereo-isomerides in that the form with the lower m.p. is the more sol.

C. R. H.

Iron pentacarbonyl as a solvent and reaction medium. M. T. Harrington (*Iowa State Coll. J. Sci.*, 1942, **17**, 74–76).— AsCl_3 , PCl_5 , and many org. compounds are sol. in $\text{Fe}(\text{CO})_5$ at room temp. With amines and N_2H_4 , $\text{Fe}(\text{CO})_5$ forms blood-red complexes of syrupy consistency which are unstable and decompose in air. The reaction involves either substitution or addition, the products with NH_2Bu^a and NH_2Et being the compounds $\text{Fe}(\text{CO})_3.4\text{NH}_2\text{Bu}^a$ and $\text{Fe}(\text{CO})_3.4\text{NEt}_3$. Free Fe could be obtained from $\text{Fe}(\text{CO})_5$ only by heating at $\sim 200^\circ$. $\text{Fe}(\text{CO})_5$ has very low electrical conductivity and this is not increased by the presence of AsCl_3 , AcOH , or Ac_2O . $\text{Fe}(\text{CO})_5$ vapour does not react with Al or Zn. Mixed with air $\text{Fe}(\text{CO})_5$ vapour ignites with slight explosion at $< 120^\circ$, but O_2 bubbled through liquid $\text{Fe}(\text{CO})_5$ causes spontaneous combustion with detonation.

J. W. S.

Ageing and co-precipitation. XXXVII. Distribution coefficient of arsenate between magnesium ammonium phosphate and solution. I. M. Kolthoff and C. W. Carr (*J. Physical Chem.*, 1943, **47**, 148–

152).— $([AsO_4]/[PO_4])_{liq.} \times (N_{PO_4}/N_{AsO_4})_{solid}$ (N = mol. fraction) = const. = 5.65 ± 0.2 at 25° over the range 1–60 mol.-% AsO_4 in the solid phase. L. J. J.

Co-ordination of silver ion with unsaturated compounds. II. cis- and trans- Δ^8 -Pentene. III. Mixtures of trimethylethylene and cyclohexene.—See A., 1943, II, 181.

Resolution of enantiomorphs. Liquid-liquid extraction.—See A., 1943, II, 229.

Hysteresis in sorption. K. S. Rao (*J. Mysore Univ.*, 1943, B, 4, 39–53).—A review (cf. A., 1941, I, 205). F. R. G.

Adsorption of ions by leached surface films on glass.—See B., 1943, I, 247.

Adsorption in relation to constitution. I. Adsorption of alkaloids by silica gel. B. P. Gyani and P. B. Ganguly (*J. Indian Chem. Soc.*, 1942, 19, 453–460).—The adsorption of morphine, nicotine, quinine, quinidine, cinchonidine, brucine, strychnine, caffeine, and piperine on SiO_2 gel from EtOH solution has been studied at 30 – 45° . Equilibrium is reached only after 20–60 days but the adsorption follows the Freundlich equation. Both the amounts adsorbed and their temp. coeffs. are large and alkaloids of similar constitution have comparable adsorption coeffs. The parallelism between the adsorption coeffs. and their poisonous qualities is discussed. J. W. S.

Theory of chromatography. D. DeVault (*J. Amer. Chem. Soc.*, 1943, 65, 532–540).—Single-solute chromatograms are discussed mathematically, ignoring diffusion and non-attainment of equilibrium, and the formation of sharp and diffuse band-edges is explained. If $q = f(c)$ (where q = amount adsorbed and c = concn.) is the adsorption isotherm of the solute, then if $f''(c)$ is >0 the trailing boundary is sharp, but if $f''(c)$ is <0 the leading boundary is sharp. Theoretical vals. for lauric acid on charcoal agree well with the data of Cassidy and Wood (A., 1942, I, 159). Partial differential equations for multiple-solute chromatograms have been obtained and the discontinuous solutions of these are discussed. Examination of the two-solute system suggests similarity to the simple systems in boundary formation, but this could not be proved. Diffuse band-edges appear to be more useful than sharp edges for studying the adsorption isotherm of the substance in the band. W. R. A.

Non-ionic surface-active agents.—See B., 1943, II, 205.

Thermodynamics of interfaces in equilibrium. H. T. Yu (*J. Chinese Chem. Soc.*, 1941, 8, 147–151).—A general equation of equilibrium is given, $\partial\omega d\sigma + \sum_{i=1}^n [\partial S_i dT - \partial V_i dp_i - RT \sum_{j=1}^n \partial M_{ij} d \log_e C_{ij}] = 0$ where σ is interfacial tension, ω area of surface, n no. of components in the system, S_i , V_i , and P_i entropy, vol., and pressure of the i th phase, M_{ij} and C_{ij} quantity in mols. and mol. fraction of the j th component in the i th phase. It is deduced that the surface tension of a non-volatile liquid is lowered by the presence of an insol. gas. Established formulæ for interfacial phenomena are derived from the new equation. F. R. G.

Energy relations in film penetration. J. Schubert and G. E. Boyd (*J. Chem. Physics*, 1943, 11, 215).—The surface concn. of Na cetyl sulphate (I) in a cetyl alcohol film on H_2O can be derived thermodynamically by means of the Gibbs equation if the variation of surface tension of the mixed film with (I) is known. L. J. J.

Silica aëroge.—See B., 1943, I, 283.

Mol. wt. and intrinsic viscosities of polyisobutylenes. P. J. Flory (*J. Amer. Chem. Soc.*, 1943, 65, 372–382).— π/c (π = osmotic pressure, c = concn.) varies non-linearly with c for cyclohexane solutions of polyisobutylenes, the form of the curve being independent of mol. wt. (π/c) $_{c=0}$ from these curves can be used to determine mol. wt. up to 1×10^6 . Intrinsic η in diisobutylene solutions obey the relation $[\eta] = kM^{0.64}$ (M = mol. wt.) over the range $M = 5.66 \times 10^3$ to 1.33×10^6 . Deviation from the Staudinger equation cannot be ascribed to a non-linear polymer structure. A definition of viscosity-average mol. wt. is given. W. R. A.

Vapour pressure equation of solutions and the osmotic pressure of rubber. A. R. Miller (*Proc. Camb. Phil. Soc.*, 1943, 39, 131).—Calculations given in a previous paper (A., 1943, I, 126) are corr. A. J. M.

Rubber molecule: its size and significance.—See B., 1943, II, 230.

Sulphonates. VII. Conductances and densities of sodium alkylbenzene- p -sulphonate solutions. R. G. Paquette, E. C. Lingafelter, and H. V. Tartar (*J. Amer. Chem. Soc.*, 1943, 65, 686–692).—Electrical conductances and ρ of solutions of Na ethyl-, n -butyl-, and n -octylbenzene- p -sulphonates have been measured at 25° , 40° , and 60° , and of solutions of p - n - $C_{12}H_{25}$ - C_6H_4 - SO_3Na at 60° . C_6H_5 rings are equiv. to $\sim 3\frac{1}{2}$ paraffin-chain C in their effect on the crit. concn. for micelle formation. W. R. A.

Electrolytic properties of solutions of paraffin-chain quaternary ammonium salts. A. B. Scott and H. V. Tartar (*J. Amer. Chem.*

Soc., 1943, 65, 692–698).—Conductances of solutions of trimethylbutyl- (I), -hexyl- (II), -octyl-, -decyl- (III), and -dodecyl-ammonium bromides (IV) at 25° , 40° , and 60° , and of $C_{16}H_{33}NMe_3Br$ at 25° have been measured. All but (I) and (II) form micelles. This was confirmed for (III) and (IV) by measurements of ρ . W. R. A.

Electrolytic properties of trimethyloctylammonium octanesulphonate and trimethyldecylammonium decanesulphonate solutions. A. B. Scott, H. V. Tartar, and E. C. Lingafelter (*J. Amer. Chem. Soc.*, 1943, 65, 698–701).—Conductance measurements show that micelles are formed at concns. \ll than for single paraffin-chain salts, and that the micelles carry approx. unit charge. W. R. A.

Osmotic properties of solutions of some typical colloidal electrolytes. J. W. McBain and O. E. A. Bolduan (*J. Physical Chem.*, 1943, 47, 94–103).—F.p. data for H_2O solutions of a no. of dialkyl sulphosuccinic esters ("Aerosols"), K laurate, decaate, and octoate, Na dehydrocholate and deoxycholate, and Tergitol 4 show a concn. range, following the very dil. region in which the KCl curve is followed, in which the f.p. decreases very slightly with a tenfold increase in concn. This process ends abruptly with a further concn. range in which the osmotic coeff. has a nearly const. low val. L. J. J.

F.p. of solutions of typical colloidal electrolytes; soaps, sulphonates, sulphates, and bile salts. S. A. Johnston and J. W. McBain (*Proc. Roy. Soc.*, 1942, A, 181, 119–133).—Conductivity alone is in many cases an untrustworthy guide to whether or not a particular solution is that of a colloidal electrolyte. Careful f.p. measurements with a no. of colloidal electrolytes show the existence of several different types, although all have in common the replacement of ions by colloidal particles with increasing concn. In the family of bile salts the conductivity almost approaches the behaviour of an ordinary electrolyte, but the lowering of f.p. falls off strongly and rather abruptly. It is pointed out that the term "critical concentration" of micelles, as often used, is either an oversimplification or a misconception, the micelle being formed over a wide range of concn. G. D. P.

Physical chemistry of resin solutions. VII. Viscosity studies in mixed solvents with some resins and cellulose derivatives. VIII. Viscosity of resins, cellulose derivatives, etc. in mixed solvents. S. R. Palit (*J. Indian Chem. Soc.*, 1942, 19, 414–424, 435–446).—VII. The viscosities (η) of solutions of ester gum in xylene-EtOH, glyptal in Bu^oOAc -EtOH, ethylcellulose in cyclohexanol-cyclohexane and EtOH-PhMe, and cellulose nitrate in EtOH-dioxan mixtures have been determined over wide concn. ranges and at 15 – 30° . With a const. solute concn. the η -solvent composition curves show min. at solvent compositions which are approx. independent of temp. but approach the optimum solvent composition with increasing solute concn.

VIII. It is shown that experimental data are qualitatively in accord with the classical viscosity equations. It is inferred that for const. solute concn. the min. η should occur in solvent containing an excess of the less viscous component as compared with the optimum solvent composition but should approach the latter with increasing solute concn. Corollaries to and tests of this rule are discussed. J. W. S.

Permeability of cellulose fibres. A. Frey-Wyssling and H. Speich (*Helv. Chim. Acta*, 1942, 25, 1474–1484).—Double refraction measurements on ramie fibres after immersion for a day in various liquids indicate that lipid liquids (hydrocarbons and their halogen derivatives) do not permeate the cell walls, but alcohols and aldehydes do so. This behaviour resembles that of starch. With ramie, however, org. bases (NH_2Ph , $NHPhMe$, quinoline) also penetrate the walls, this behaviour being attributed to the presence of CO_2H groups in the cellulose. Ramie fibres have double refraction and d deficiencies of 4.4 and 12.6%, respectively, as compared with cryst. cellulose. J. W. S.

Determination of mol. wt. and polydispersity for nitrocellulose fractions by means of the sedimentation equilibrium ultracentrifuge. H. Mosimann (*Helv. Chim. Acta*, 1943, 26, 369–398).—Results of mol. wt. determinations by means of the sedimentation equilibrium ultracentrifuge are recorded for nitrocellulose fractions (mol. wt. 10,000–80,000). Even carefully fractionated products may have a distribution of particle size with >1 max. The Staudinger viscosity law holds as a limiting law over small ranges of mol. wt. F. J. G.

General electrophoretic pattern in extracts of pollens causing hay fever.—See A., 1943, III, 443.

Solubility and electrophoretic studies of serum-globulins. I. γ -Globulin. E. Jameson and C. Alvarez-Tostado (*J. Amer. Chem. Soc.*, 1943, 65, 459–465).—The prep. of homogeneous constituents of γ -globulins is described, using K citrate in place of $(NH_4)_2SO_4$ which induces heterogeneous mixtures when used in the usual manner as shown by solubility behaviour. Const. solubilities were found for two fractions. Electrophoretic measurements on four fractions and ascertained solubility data are explained in terms of a mobile equilibrium between a complex and its components. W. R. A.

VI.—KINETIC THEORY. THERMODYNAMICS.

Calculation of chemical equilibria in gaseous systems by the aid of the Nernst equations or from entropies; application to various equilibria, especially that of nitric oxide. E. Briner (*Helv. Chim. Acta*, 1942, 25, 1515—1527).—Equilibrium data for the systems $2\text{NO} \rightleftharpoons \text{N}_2 + \text{O}_2$, $\text{CO} + \text{H}_2\text{O} \rightleftharpoons \text{CO}_2 + \text{H}_2$, $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$, and $2\text{O}_3 \rightleftharpoons 3\text{O}_2$ as calc. from the Nernst equations, are in satisfactory agreement with the vals. calc. from entropy data and with experimentally determined vals. It is suggested, therefore, that the approx. equation can be used satisfactorily for calculating these data by Nernst's method, especially when entropy data are lacking.

J. W. S.

Vapour pressures of halogen acids. S. P. Walvekar, N. L. Phalnikar, and B. V. Bhide (*J. Univ. Bombay*, 1943, 11, A, Part 5, 69—76).—Lowering of the v.p. of HCl in CCl_4 and in $n\text{-C}_6\text{H}_{14}$ and of HBr in CCl_4 by addition of PhOMe may be due to formation of $[\text{PhOMe}]\text{X}$, although the equilibrium consts. $K = C_{\text{complex}} / (C_{\text{free HCl}} \times C_{\text{free PhOR}})$ for $\text{C}_6\text{H}_5\text{R-OMe}$ (R = H, *p*-Cl, -NO₂, -OMe, -Me, *o*-NO₂, *m*-OMe) exhibit no relationship to the velocity coeffs. of their hydrolysis. No lowering occurred in C_6H_6 .

F. R. G.

Quantitative investigations of amino-acids and peptides. XIII. Equilibria between histidine and formaldehyde. XIV. Equilibria between amino-acids and formaldehyde: arginine and lysine. E. H. Frieden, M. S. Dunn, and C. D. Coryell (*J. Physical Chem.*, 1943, 47, 85—94, 113—133; cf. A., 1943, 1, 181).—XIII. Polarimetric titrations give vals. 0.74 , 6.6×10^3 , 1.68×10^3 , 4.2×10^4 , 1.45×10^5 for the equilibrium consts. L_{11} , L_{12} , L_{22} , L_{13} , and L_{23} (using Levy's terminology), respectively, for the reaction between histidine and CH_2O . Each of the three ionic forms of histidine reacts with 2 successive CH_2O mols.

XIV. $l(+)$ -Arginine and CH_2O react by an instantaneous and probably reversible combination of 1 mol. of each, followed by slow irreversible combination of the product, involving the guanidino-group, with a further CH_2O . $l(+)$ -Lysine shows two main equilibria followed by complex formation, with equilibrium consts. differing from those found by Levy (cf. A., 1935, 703).

L. J. J.

Association of boron trifluoride additive compounds with amines in non-polar solvents. J. R. Bright and W. C. Fernelius (*J. Amer. Chem. Soc.*, 1943, 65, 735—736).—Mol. wt. determinations on NMe_2BF_3 and $\text{NPhMe}_2\text{BF}_3$ indicate association. Vals. of the association consts. for equilibria between mono- and di-, mono- and tri-, and mono- and tetra-merides are in no case consistent with the assumption that each of these equilibria is independent of the others.

W. R. A.

Two protons in one step. G. Schwarzenbach and R. Sulzberger (*Helv. Chim. Acta*, 1943, 26, 453—459).—The structural conditions for a diprotic acid to have $K_2 \gg K_1$ are discussed. They are fulfilled by the cation $[\text{p-OH-C}_6\text{H}_4\text{-NH-CH-CH-CH-CH-CH-CH-NH-C}_6\text{H}_4\text{-OH-p}]^+$, which has $\text{p}K_1 = 8.75$ and $\text{p}K_2 = 3.25$ at 20° and ionic strength = 0.2.

F. J. G.

Effect of substituents on acid strength of benzoic acid. VI. Cyano-group. M. Kilpatrick and R. D. Eanes (*J. Amer. Chem. Soc.*, 1943, 65, 589—590).—Relative acid strengths of *m*- and *p*-CN- $\text{C}_6\text{H}_4\text{-CO}_2\text{H}$ have been determined in H_2O , $(\text{CH}_3)_2\text{OH}$, MeOH, EtOH, and dioxan- H_2O mixtures at 25° , in all of which the *p*-acid is the stronger.

W. R. A.

Approximate estimation of the isoelectric point of soluble proteins.—See A., 1943, III, 517.

Ionisation constants of substituted phenylarsonic acids. D. Pressman and D. H. Brown (*J. Amer. Chem. Soc.*, 1943, 65, 540—543).—First and second ionisation consts. of 19 substituted phenylarsonic acids in H_2O at 22° are given. Substituents change the first and second const. by the same factor. *m*- and *p*-substituents introduce effects similar to those in BzOH , and *o*-substituents to those in BPh(OH)_2 .

W. R. A.

High mol. wt. aliphatic amines and their salts. X. Ionisation constants of primary and symmetrical secondary amines in aqueous solution. C. W. Hoerr, M. R. McCorkle, and A. W. Ralston (*J. Amer. Chem. Soc.*, 1943, 65, 328—329).—Ionisation consts. for the *n*-primary aliphatic amines containing 4—18 C, isobutyl-, isoamyl-, and docosyl-amines, and symmetrical normal *sec.* aliphatic amines (with 6, 8, 12, 13, 15, and 18 C in chain) have been calc. from measurements of Λ .

W. R. A.

Bearing of the dissociation constant of urea on its constitution. J. Bell, W. A. Gillespie, and D. B. Taylor (*Trans. Faraday Soc.*, 1943, 39, 137—140).—The basic dissociation const. of $\text{CO(NH}_2)_2$, remeasured, is $\sim 1.47 \times 10^{-14}$ at 21° ; acidic dissociation is undetectable. A zwitterion structure is not compatible with these results, and an explanation of the monobasicity of $\text{CO(NH}_2)_2$ and the low val. of its dissociation const. by means of a resonance hybrid is suggested.

F. L. U.

Stability of racemates. Mandelic acid and its derivatives.—See A., 1943, II, 229.

Temperature-concentration equilibria in the system dimethyl-aniline-sulphur dioxide. J. R. Bright and W. C. Fernelius (*J. Amer. Chem. Soc.*, 1943, 65, 637—639).—The m.p. curve for $\text{NPhMe}_2\text{-SO}_2$ shows two eutectics and a max. corresponding with the compound $\text{NPhMe}_2\text{SO}_2$ (I). (I) has m.p. 12° , d_4^{25} 1.08, and separates as a red oil on adding light petroleum to the mixture. It is associated in NPhMe_2 .

W. R. A.

Phase behaviour of lithium palmitate with water and with lithium chloride and water. M. J. Vold (*J. Amer. Chem. Soc.*, 1943, 65, 465—469).—The Li palmitate- H_2O system has been studied and compared with the Na palmitate- H_2O system. At high soap concns. the binding power of H_2O in superneat soaps and the H_2O in soap of max. thermal stability follow the order $\text{Li} > \text{Na} > \text{K}$. Li palmitate-LiCl- H_2O systems are described containing up to 2% LiCl, which increases the stability of the more solid phases.

W. R. A.

Determination of equilibrium diagrams by X-ray methods. I. Determination of phase boundaries in equilibrium diagrams by X-ray methods. E. A. Owen. II. Application of X-ray methods to determination of phase boundaries in metallurgical equilibrium diagrams. W. Hume-Rothery. III. Examination of heat-treated alloys by X-rays and by the microscope. A. J. Bradley. IV. Metallurgist's point of view. M. L. V. Gayler. V. Discussion (*J. Inst. Metals*, 1943, 69, 2—8, 8—12, 12—15, 15—17, 18—27).—A discussion of the advantages and limitations of X-rays and of the relative val. of this method and the microscope in the determination of equilibrium diagrams.

A. R. P.

Liquid-liquid phase equilibria of the system cyclohexane-methyl alcohol in presence of various salts as third components. E. L. Eckfeldt and W. W. Lucasse (*J. Physical Chem.*, 1943, 47, 164—183).—A phase curve for the system has been obtained. The crit. solution temp. is 45.14° . The effects of NaCl, NaBr, NaI, NaNO_3 , and NaCNS at various concns. up to saturation have been determined. The anionic lyotropic order is $\text{I}^- > \text{CNS}^- > \text{Br}^- > \text{Cl}^- > \text{NO}_3^-$.

L. J. J.

Lyotropic order and effects of sodium salts on miscibility of cyclohexane and methyl alcohol. E. L. Eckfeldt and W. W. Lucasse (*J. Physical Chem.*, 1943, 47, 183—189; cf. preceding abstract).—Salting-out action on the reverse order effect found with cyclohexane-MeOH depends on the net result of competing electrostatic effect, compound formation, and ionic polarisation.

L. J. J.

Effect of temperature on liquid-liquid equilibrium. Benzene-acetone-water system and docosane- α -diphenylhexane-furfuraldehyde system. S. W. Briggs and E. W. Comings (*Ind. Eng. Chem.*, 1943, 35, 411—417).—The phase equilibria of both systems have been investigated over a range of temp. Binodal curves representing the boundary between uni- and di-phase regions and tie lines have been constructed at 15° , 30° , and 45° . Temp. affects the two systems differently. For $\text{C}_{22}\text{H}_{46}\text{-COMe}_2\text{-H}_2\text{O}$ it alters the slope of the tie-lines but changes solubility only slightly; in the other system it hardly affects tie-line slope but brings about a decided change in solubility. The effect of temp. on the no. of stages required for given separations is discussed.

C. R. H.

Ternary and binary vapour-liquid systems. Method of tie-line interpretation for phase equilibrium relations. C. E. Dryden (*Ind. Eng. Chem.*, 1943, 35, 492—494).—A method of correlating equilibrium distribution relations of the solute between conjugate phases on a solvent-free basis in liquid-liquid and vapour-liquid systems and its applications to the graphical solution of the Maloney-Schubert diagram (cf. B., 1941, 1, 47) for theoretical extraction stages are presented.

C. R. H.

Equilibrium in the hydrogen-methane-steel system. C. F. Gray (*Iowa State Coll. J. Sci.*, 1942, 17, 66—68).—The equilibrium between H_2 , CH_4 , and the Fe_3C in steel has been studied at 750 — 900° and the equilibrium const. calc. from the relation $K = N_{\text{Fe}_3\text{C}} \times N_{\text{H}_2}^2 \times P / (N_{\text{Fe}}^2 \times N_{\text{CH}_4})$, where N_{H_2} and N_{CH_4} refer to mol. fractions in the gas phase and $N_{\text{Fe}_3\text{C}}$ and N_{Fe} to mol. fractions in the solid. From the results the heat of the reaction $3\text{Fe} (\gamma) \text{ (in austenite)} + \text{CH}_4 = \text{Fe}_3\text{C} (\beta) \text{ (in austenite)} + 2\text{H}_2$ is calc. to be 23,500 g.-cal. at 850° . Combining this result with heat capacity and transition data, the heat of the reaction $3\text{Fe} (\alpha) + \text{CH}_4 \rightleftharpoons \text{Fe}_3\text{C} (\alpha) + 2\text{H}_2$ is calc. to be 14,700 g.-cal. at 25° .

J. W. S.

Merwinite in the system CaO-MgO-SiO_2 .—See A., 1943, I, 188.

Ternary system $\text{CaO-P}_2\text{O}_5\text{-SiO}_2$.—See B., 1943, I, 291.

Heats of dilution of aqueous solutions of glycine at 25° . W. E. Wallace, W. F. Offutt, and A. L. Robinson (*J. Amer. Chem. Soc.*, 1943, 65, 347—350).—Heats of dilution of aq. glycine (0.8—0.0003M) have been measured at 25° and partial molal heat contents have been calc. The behaviour in very dil. solutions conforms more closely to the theory of Fuoss than do previously existent data.

W. R. A.

Entropy of hydration of gaseous ions. F. H. Lee and Y. K. Tai (*J. Chinese Chem. Soc.*, 1941, 8, 184—193).—The theoretical entropy of hydration is calc. to be $\Delta S = -6.4 - k(1 - 1/n)r$, where k is

19.5 for univalent and 58.5 for bivalent ions, r is the ionic radius, and n is the repulsion exponent (cf. Pauling, A., 1927, 399), in good agreement with experimental vals. F. R. G.

Heat of hydration of gaseous ions. F. H. Lee and Y. K. Tai (*J. Chinese Chem. Soc.*, 1942, 9, 41—45; cf. preceding abstract).—The authors' theory by which the entropy of hydration of gaseous ions was expressed as a function of ionic radii has been extended to cover the heats of hydration of gaseous ions. The results accord with experimental data for alkali and alkaline-earth metal ions. J. W. S.

Thermodynamic properties of air at low temperatures.—See B., 1943, I, 264.

Thermodynamics of aqueous potassium bromide at 25° from e.m.f. measurements on cells with transference. E. A. MacWilliam and A. R. Gordon (*J. Amer. Chem. Soc.*, 1943, 65, 984—985).—E.m.f. of the cell with transference $\text{Ag}|\text{AgBr}|\text{KBr}(m_1)|\text{KBr}(m_2)|\text{AgBr}|\text{Ag}$ has been measured at 25° for concns. up to 0.1M. Calc. vals. for activity and osmotic coeffs. at various concns. agree well with those obtained by other methods. W. R. A.

VII.—ELECTROCHEMISTRY.

Conductance of aqueous solutions of magnesium perchlorate. P. van Rysselberghe and J. M. McGee (*J. Amer. Chem. Soc.*, 1943, 65, 737—738).—Vals. for Λ^{25} for aq. $\text{Mg}(\text{ClO}_4)_2$ from 0.001 to 6.588 equiv. per l. are given. Λ^{25} is 128.5 mho. W. R. A.

Transference numbers of potassium bromide in aqueous solution at 25°. A. G. Keenan and A. R. Gordon (*J. Chem. Physics*, 1943, 11, 172—174).—Data for 25° and $[\text{KBr}]$ up to 0.1N., obtained with autogenic cation boundaries with CdBr_2 as indicator, sheared anion boundaries with KIO_3 as indicator, and falling cation boundaries with LiBr as indicator, are recorded. L. J. J.

Single potential difference at a cadmium electrode. J. A. Chalmers (*Phil. Mag.*, 1942, [vii], 34, 349—353).—The scraped electrode method indicates that the "null" solution for a Cd electrode in CdSO_4 is $\sim 1.5N$. The single electrode potential of Cd is ~ -0.005 v. A. J. M.

Contact potentials. J. A. Chalmers and W. Hume-Rothery (*Phil. Mag.*, 1943, [vii], 34, 213).—A correction (cf. A., 1942, I, 268). A. J. E. W.

Effect of addition of salts on hydrogen overvoltage. G. A. Eaton (*Iowa State Coll. J. Sci.*, 1942, 17, 54—56).—The H-overvoltage (η) of Fe in 0.02—2N-NaOH decreases with increasing $[\text{NaOH}]$, especially at high c.d. Except at very low c.d. (0.1 ma. per 2.25 sq. cm.) where a consistent increase in η is observed with increasing additions of Na_2SO_4 , η in $\text{NaOH}-\text{Na}_2\text{SO}_4$ solutions passes through a max. when $[\text{NaOH}] = [\text{Na}_2\text{SO}_4]$. In aq. KOH η is $<$ in aq. NaOH, whilst in aq. $\text{Ba}(\text{OH})_2$ η is higher at low c.d. and lower at high c.d. than in KOH or NaOH. In $\text{Ba}(\text{OH})_2-\text{BaCl}_2$ solutions η is $>$ in $\text{NaOH}-\text{NaCl}$ or $\text{KOH}-\text{KCl}$ solutions, when the solutions are 2N. in the chlorides and 0.2N. in the hydroxides, whilst it is still greater in $\text{NaOH}-\text{NaCl}$ than in $\text{KOH}-\text{KCl}$. In 2N-NaOH η is decreased by the addition of NaAlO_2 or Na_2SiO_3 but is increased by the addition of Na_3PO_4 or NaCl . The interpretation of these results is discussed. J. W. S.

Deviations between observed and calculated polarographic diffusion currents. W. M. MacNevin and E. W. Balis (*J. Amer. Chem. Soc.*, 1943, 65, 660—665).—Diffusion currents of Cd^{2+} , Zn^{2+} , Cu^{2+} , Pb^{2+} , Ti^{3+} , and $\text{Fe}(\text{CN})_6^{4-}$ in 0.1M- NO_3^- solutions have been measured polarographically. Deviations from the Ilkovič equation are due, not to complex ion formation, reaction with Hg, or irregularities in drop-formation, but to stirring effects. Departures from theory were observed when photomicrographic examination showed that the cathode drops were spherical and that secondary remaining drops produced a negligible effect, as Ilkovič assumed. Effects of mechanical agitation by N_2 bubbles and of varying cathode drop-rates on the deviations have been determined. W. R. A.

VIII.—REACTIONS.

Unimolecular reactions. D. D. Eley (*Trans. Faraday Soc.*, 1943, 39, 168—172).—The conditions under which the "square-term" and "transition-state" formulæ are applicable to unimol. reactions are discussed. For the special case of "fast" reactions an experimental criterion is described whereby it may be ascertained which is the rate-determining step, and consequently which formula is appropriate. A particular limitation of the "square-term" formula is pointed out. F. L. U.

Thermal decomposition of hydrocarbons, resonance stabilisation, and isomerisation of free radicals. A. Kossiakoff and F. O. Rice (*J. Amer. Chem. Soc.*, 1943, 65, 590—595).—Free radicals formed in the thermal decomp. of paraffins are stabilised by resonance, which is least in primary and greatest in *tert.* radicals. Resonance

accounts for differing rates of removal of primary, *sec.*, and *tert.* H atoms from hydrocarbons by free radicals. Long-chain radicals may isomerise internally, e.g., *n*- to *isohexyl*. These factors are considered in calculating the proportions of products from hexanes, heptanes, and octanes, giving improved agreement with experimental data. W. R. A.

Kinetics of polymerisation reactions. I. First-order initiation reactions. II. Second- and combined second- and first-order initiation reactions. Mutual stabilisation of growing chains. R. Ginell and R. Simha (*J. Amer. Chem. Soc.*, 1943, 65, 706—715, 715—727).—I. A mathematical theory of polymerisation, involving the rate of formation of nuclei, their rate of growth, and the rate of cessation of growth, is developed. The relation between the final average chain length and chain length distribution and the rate coeffs. and initial concn. is discussed when the ratios rate of cessation to rate of initiation and rate of propagation to rate of cessation of growth are (a) large and (b) small. For (a) the average mol. wt. is large and approx. const. in the last stages whilst for (b) the average mol. wt. increases continuously, reaching a final small val. Reaction rate coeffs. can be determined.

II. When initiation is second order the final average mol. wt. is smaller, approaching the previous vals. if the rate of initiation becomes very small. Final average chain length does not depend on initial concn. Mutual cessation of growth of chains, and its effect on final average mol. wts. and chain length distribution, are considered. W. R. A.

Kinetics of hypoiodite decomposition. C. H. Li and (Miss) C. F. White (*J. Amer. Chem. Soc.*, 1943, 65, 335—339).—Hypoiodite was determined by its rapid reaction with tyrosine. In strongly alkaline solution the rate law at 25° is $-d[\text{OI}']/dt = 2.9[\text{OI}'] + 104[\text{OI}']^2[\text{I}']/[\text{OH}']$. Heat of activation for the second path, calc. from the rate laws at 25° and 2°, is 12.4 kg.-cal. Mechanisms for each path are proposed. W. R. A.

Kinetics of exchange reactions of the type $\text{RI} + \text{I}' \rightleftharpoons \text{RI}' + \text{I}$ in alcoholic solution. H. A. C. McKay (*J. Amer. Chem. Soc.*, 1943, 65, 702—706).—Reaction of alkyl iodides with radio-I ion in EtOH is bimol. Velocity and temp. coeffs. and energies of activation have been determined. Variation of bimol. velocity coeff. with concn. of reactants has been studied for EtI at 30°. W. R. A.

Deuterium exchange in the system hydrogen deuteride-methyl alcohol. A. G. Gassman, C. J. Hochenadel, and R. J. Hartman (*J. Amer. Chem. Soc.*, 1943, 65, 988).—Velocity coeffs. of the esterification, catalysed by DCl, of 9 aromatic acids have been determined. Identity with vals. of the HCl-catalysed reaction is adduced as evidence for D exchange. W. R. A.

Action of free radicals on para-hydrogen. III. Dipyridinium radicals. G. M. Schwab, E. Schwab-Agallidis, and N. Agliardi (*Ber.*, 1940, 73, [B], 279—285).—Measurement of the *p*-H transformation in MeOH combined with measurements by other authors in different solvents shows that the mol. rate of transformation in valency-saturated liquids is additively composed of a const. contribution of induced magnetic moments and a contribution of the nucleus moments of each proton. Towards *p*-H 1 : 1'-dibenzyl-4 : 4'-dipyridinium is not a diradical and its monochloride is a completely dissociated monoradical. H. W.

Hydrolysis. II. Comparison of the saponification constants of the phenyl esters of fatty acids with those of their cyclohexyl esters. B. E. Mirza and G. D. Advani (*J. Univ. Bombay*, 1943, 11, A, Part 5, 63—68; cf. A., 1942, I, 243).—Velocity coeffs. are recorded for the saponification by EtOH-KOH of Ph and cyclohexyl esters of AcOH, EtCO₂H, and Pr^oCO₂H and of cyclohexyl isobutyrate. For a given acid, the coeff. for the cyclohexyl is ~ 28 times that of the Ph ester. F. R. G.

Kinetics of phloroglucinolcarboxylic acid. E. Baur and P. Giger (*Helv. Chim. Acta*, 1943, 26, 450—453).—The work of Widmer (A., 1929, 517) has been repeated and confirmed. The plot of reaction rate against distance from equilibrium in the neighbourhood of the equilibrium point forms two straight lines intersecting sharply at the origin. F. J. G.

Kinetics of hæmoglobin reactions. D. D. Eley (*Trans. Faraday Soc.*, 1943, 39, 172—181).—The data of Hartridge and Roughton (cf. A., 1923, 229, 746; 1925, 557; 1934, 1073; 1937, III, 2) are discussed from the point of view of transition-state theory, and vals. of the energy and entropy of activation are calc. for the reactions of hæmoglobin with O_2 and with CO in aq. solution. By the standards of chemical kinetics the reaction with CO appears to be fairly normal, whilst that with O_2 is not, the difference between the activation energies of the forward and back reactions differing greatly from the heat of reaction. The association reactions are characterised by their low activation energy, and the dissociation by its high entropy of activation. It is suggested that this may be due to loosening of the structure of the protein on forming an activated complex. The activated complexes are probably different for the forward and back reactions. F. L. U.

Resolution and rates of hydrolysis of *dl*- α -bromopropionic acid and its glycine derivatives.—See A., 1943, II, 215.

Inversion of *l*-menthone and reaction of diazoacetic ester with chloroacetic acids. Inversion of menthone with trichloroacetic acid in aprotic solvents. Influence of addenda on inversion of *l*-menthone with acids in benzene.—See A., 1943, II, 202.

Disappearance of thiosulphate in solutions of maleic acid; catalysis of *cis-trans*-isomerisation. H. Taube (*J. Amer. Chem. Soc.*, 1943, **65**, 526—531).—Disappearance of $S_2O_3^{2-}$ in maleic acid (I) solutions proceeds by two paths, the importance of each path depending on the acidity. Two paths are also observed in the formation of fumaric acid in solutions of (I) and $S_2O_3^{2-}$, similar in nature to the corresponding paths for $S_2O_3^{2-}$ decomp. Catalysis of the *cis-trans* isomerisation by the reaction of H_2S and SO_2 was examined. W. R. A.

Effects of inorganic electrolytes on the liberation of $-SH$ in proteins. N. F. Burk (*J. Physical Chem.*, 1943, **47**, 104—118).—Many electrolytes inhibit liberation of titratable $-SH$ in solutions of ovalbumin (I), edestin (II), and lactalbumin (III), denatured by $CO(NH_2)_2$ or $CaCl_2$. Inhibition increases in the order of the Hofmeister series. A lyotropic series $Mg^{++} < Mn^{++} < Ba^{++} < Ca^{++}$ is found for denaturation of (II). $MgCl_2$ and $MnCl_2$ inhibit liberation of $-SH$ at high, but produce it at low, concns., whilst their sulphates and acetates inhibit at all concns. Opposite effects on (I) and (III) are found with HCl and $MgCl_2$. Denaturation of (III) by $CaCl_2$ is inhibited by cations in the order $Na^+ < K^+ < NH_4^+ < Mg^{++} < H^+$, and is also produced by $Ca(OAc)_2$. L. J. J.

Decomposition of ethylene and carbon monoxide on metallic catalysts. A. R. McKinney (*J. Physical Chem.*, 1943, **47**, 152—163).—Of the metals Co, Cu, Fe, Ni, Os, Pd, Pt, Zn, prepared under uniform conditions, only those which form carbonyls catalyse decomp. of CO. Decomp. of C_2H_4 is related to at. radius. L. J. J.

Catalytic decomposition of ethyl alcohol in presence of magnesium oxide. T. T. Castonguay (*Iowa State Coll. J. Sci.*, 1942, **17**, 37—39).—The products of the decomp. of EtOH vapour on MgO at 365—457°/1 atm. include $MeCHO$, Pr^aCHO , $COMePr^a$, Bu^aOH , $COMe_2$, and $(CH_3)_2CH_2$. The decomp. under pressure in the presence of MgO at 394—497° yields a complex mixture of products. J. W. S.

Surface area and catalytic activity of zinc oxide pigments. C. W. Siller (*J. Amer. Chem. Soc.*, 1943, **65**, 431—434).—Prep. of ZnO pigments with different sp. surfaces, but the same surface characteristics, is described. Catalytic activity per g. for the decomp. of $MeOH \propto$ the sp. surface measured microscopically. W. R. A.

Application of palladium- and platinum-polyvinyl alcohol-vanadium catalysts. L. D. Rampino and F. F. Nord (*J. Amer. Chem. Soc.*, 1943, **65**, 429—431).—Reduction of $PhCHO$, cinnamaldehyde, maleic acid, benzoquinone, and I is described. Vanadous catalysts with O_2 -free H_2 establish the dispensability of O_2 in noble metal reductions. W. R. A.

Catalytic activity of activated nitrogenous carbons. P. F. Bente and J. H. Walton (*J. Physical Chem.*, 1943, **47**, 133—148).—A no. of nitrogenous C and one sugar C sample showed optimum activation at 875° for effect on (i) decomp. of H_2O_2 , (ii) oxidation of quinol, and (iii) oxidation of K urate, with activity decreasing in the same order for each reaction. C from $(CH_2)_6N_4$ has a very high activity. Adsorption of O_2 produces decay for reactions (i) and (iii) only, and 0.001N-KCN inhibits the action of nitrogenous C, but not of sugar C. I adsorption \propto surface area, but is not correlated with the (small) active surface. L. J. J.

Oxidation of resorcinol by hydrogen peroxide in presence of tungstic acid sol as catalyst.—See A., 1943, II, 217.

Electrolysis of manganous sulphate and sulphuric acid. D. N. Solanki and M. Prabhajanmurti (*J. Indian Chem. Soc.*, 1942, **19**, 473—480).—A detailed study of the electrolysis of $MnSO_4$ and H_2SO_4 under various conditions has been made in order to find the optimal yields of oxidation products. The ranges over which the conditions were varied are followed by the optimum vals. in the list below: $[H_2SO_4]$ 30—90%, 60%; $[MnSO_4]$ 1.5—9%, 7.5%; temp. 15—80°, 60°; inter-electrode distance, 2—9 cm., 5.5 cm.; anodic c.d., 100—480, 300 amp. per dm^2 ; cathodic c.d., 52—750, 270 amp. per dm^2 ; current concn., 0.0105—0.025, 0.019 amp. per c.c. The nature of the anodic material affects the results considerably. With a graphite anode there was no oxidation. The effect of 18 catalysts was studied. $Ce(SO_4)_2$, KIO_3 , $CoSO_4$, $Pb(OAc)_2$, and HF considerably improved the current efficiency for anodic oxidation. $Tl_2(SO_4)_3$, KI , and HCl were negative catalysts. An explanation of the catalytic effect is offered. If a.c. is superimposed on the d.c. electrolysing current, the current efficiency improves greatly. The latter, however, is decreased by passing steam through the electrolyte, probably owing to agitation of the electrolyte. A. J. M.

[Electrolytic] surface protection of magnesium alloys.—See B., 1943, I, 301.

Photochemistry of the formation of sulphuryl chloride. M. C. Londergan (*Iowa State Coll. J. Sci.*, 1942, **17**, 95—97).—The photochemical reaction between SO_2 and Cl_2 has been studied at 70° and initial pressures 12—60 mm. With 4358 Å. radiation the quantum efficiency is 1.2 ± 0.2 . This is interpreted as indicating that it is possible for the excited Cl_2 mol. to combine directly with a SO_2 mol. The equilibrium const. of the dissociation of SO_2Cl_2 has been studied in the presence of animal charcoal at 70—100° and the heat of dissociation ΔH_0 calc. as 12,795 g.-cal. per g.-mol. An expression for the free energy of dissociation of SO_2Cl_2 at any temp. is also given. J. W. S.

Inhibitory effect of iodine on the photolysis of gaseous hydrogen iodide. R. A. Ogg, jun., and R. R. Williams, jun. (*J. Chem. Physics*, 1943, **11**, 214—215).—The ratio of the rate coeffs. k_2/k_1 for the reactions $H + HI \rightarrow H_2 + I$ (i), $H + I_2 \rightarrow HI + I$ (ii) in $HI-I_2$ mixtures with $[HI]$ 50—150 mm. and $[I_2]$ 0—20 mm. Hg at 108° is 4.9 ± 0.3 , independent of temp. over $\sim 50^\circ$ range. Reaction (ii) must have a small finite activation energy. L. J. J.

Latent image formation.—See B., 1943, II, 234.

Photochemical reactions between vinyl chloride and chlorine or bromine, leading to the formation of $\alpha\alpha\beta$ -trichloroethane and $\alpha\beta$ -dibromochloroethane. R. Schmitz and H. Schumacher (*Z. physikal. Chem.*, 1942, **B**, 52, 72—89).—The photochemical chlorination of $CH_2=CHCl$ (I), affording $CH_2Cl-CHCl_2$ (II), at a pressure of (I) $> \sim 70$ —100 mm., accords with $+d[(II)]/dt = k[I_{abs.}]^{1/2}[Cl_2]$. The quantum yield is high ($\sim 10^5$) and the temp. coeff. only very slightly > 1 . O_2 strongly inhibits the reaction. The photochemical bromination of (I), affording $CH_2Br-CHClBr$ (III) accords with $+d[(III)]/dt = k[Br_2][I_{abs.}]^{1/2}[(I)]^{1/2}$. The quantum yield is $\sim 10^5$, and the temp. coeff. 0.85 for 10°. O_2 strongly inhibits the reaction. Mechanisms for both reactions are proposed. F. J. G.

Intermediate step in the autoxidation of quinol. Aerial fogging of photographic emulsions. T. H. James (*J. Chem. Physics*, 1943, **11**, 183—187).—Neither chemiluminescence nor H_2O_2 can account for aerial fog during oxidation of quinol in presence of photographic emulsions, since the former is undetectable during aerial fogging, and very large $[H_2O_2]$ is required to produce a comparable effect. A transitory radical, probably HO_2' or O_2' , is suggested as the fogging agent. L. J. J.

Photo-oxidation of quinine. T. L. Rama Char (*J. Indian Chem. Soc.*, 1942, **19**, 447—452).—The photochemical oxidation of quinine hydrochloride by $UO_2(NO_3)_2$, $NaVO_3$, and $K_2Cr_2O_7$ has been studied, the sols produced in the presence of the last two reagents being peptised. In the oxidation by $UO_2(NO_3)_2$ the velocity of reaction $v \propto$ the intensity of light absorbed (I) whilst in the reaction with $NaVO_3$ and $K_2Cr_2O_7$, $v \propto I \times [\text{sol}]$. For the reaction with $NaVO_3$ in *l*-circularly polarised light v is $>$ for the reaction in *d*-circularly polarised light, as predicted from the circular dichroism exhibited by the sols in the ultra-violet spectral region. J. W. S.

Photo-oxidation of chlorophyll. S. Aronoff and G. Mackinney (*J. Amer. Chem. Soc.*, 1943, **65**, 956—958).—Photo-oxidation of chlorophyll *a* and *b*, and the retardation by carotene (I), have been studied kinetically. Oxidation is probably second order and has a low quantum efficiency. Protective action becomes const. in solutions containing > 1 mol. of (I) to 8 mols. of chlorophyll. W. R. A.

Chemical processes involving radio-bromine. Behaviour of ethyl bromide on radio-activation in the gas phase and the reaction between the active bromine atoms produced and acetylene. H. Suess (*Z. physikal. Chem.*, 1940, **B**, 45, 297—311).—Mixtures of EtBr vapour and HBr and DBr, with and without C_2H_2 , were activated by neutrons and, by analysing the H_2O -sol. and org. portions of the system, the fate of Br^* has been determined. With C_2H_2 absent, Br^* is found as HBr^* , indicating ejection of Br^* from EtBr. When C_2H_2 is present, org. Br^* compounds are formed, the amount depending on the partial pressure of C_2H_2 and increasing on replacement of HBr by DBr. That unchanged Br^* atoms are produced has been proved by activation experiments in electric fields. Rate of addition of Br^* to C_2H_2 is \gg the rate of exchange with HBr. Br^* does not perceptibly react with H. W. R. A.

Behaviour of hydrogen bromide in nuclear processes of bromine. H. Suess (*Z. physikal. Chem.*, 1940, **B**, 45, 312—322).—When EtBr is bombarded by neutrons in the presence of HBr and C_2H_6 , radio-Br is produced by four processes: (1) capture of neutron by EtBr; (2) capture of neutron by HBr or DBr; (3) transition of $H^{80}Br^*$ (4.5 hr.) into $H^{80}Br$ (18 min.); (4) photochemical formation of ^{82}Br . (1) involves rupture of the mol. binding of Br; in (2) the emitted γ -quanta are usually not great enough to rupture the mol. binding; whilst in (3) excited HBr^* is formed. W. R. A.

Decomposition of potassium iodide by ultrasonic waves. J. N. Bhar (*J. Counc. Sci. Ind. Res., India*, 1943, **1**, 106—108).—Supersonic waves (ν not stated) cause partial decomp. of KI solutions to give free I, the % decomp. decreasing (14.7—0.13%) with increasing concn. (0.006—0.4N.). $> 90\%$ of the I from 0.5N-KI was recovered

by repeated (18 times) removal of I on activated C followed by re-exposure of the solution.
M. H. M. A.

IX.—PREPARATION OF INORGANIC SUBSTANCES.

"Inorganic benzene," $B_3N_3H_6$. E. Wiberg and A. Bolz (*Ber.*, 1940, 73, [B], 209—232).—At room temp. B_2H_6 and NH_3 give the compound, $B_2H_6 \cdot 2NH_3$, independent of the excess of NH_3 . At higher temp. with a large excess of NH_3 the product is $B_2(NH_3)_3$ and thence BN. Borazene (I), $B_3N_3H_6$, b.p. 55.0° , m.p. -58.0° (many other physical data recorded), is best obtained from B_2H_6 and NH_3 (mol. ratio 1:2) at $>200^\circ/1$ atm. Its constitution, $BH \langle \begin{smallmatrix} NH \cdot BH \\ \cdot NH \cdot BH \end{smallmatrix} \rangle NH$, follows in that it gives 2 Me derivatives one of which is hydrolysed to $B(OH)_3$, NH_2Me , and H_2 whilst the other yields NH_3 and $BMe(OH)_2$. The fine structure shows a very close relationship to that of C_6H_6 . The mode of formation is discussed. (I) is more reactive than C_6H_6 . At room temp. and in absence of catalyst it adds 3 mols. of compounds HX (X = Cl, Br, OH, OMe), giving derivatives (II) of "inorg. cyclohexane." NH_3 is added slowly and in a complex manner. At $50-100^\circ$ (II) evolve 3 H_2 and give the "aromatic system" so that the ultimate effect is a substitution in (I). Thus (I) and HBr at 100° afford $B_3N_3H_3Br_3$; alternatively, the re-formed "aromatic ring" may disrupt into three similar components. If (II) are heated in presence of HX, HX adds to the double linkings formed by loss of H_2 from (I), the end effect therefore being substitution of H by X with evolution of H_2 from the cyclohexane mol. Attempted hydrogenation of (I) in presence of finely-divided Ni at 190° causes fission of the ring and production of compounds of high mol. wt.; similar condensation occurs in presence of Pd at 50° . With excess of Br at 0° (I) affords a yellow additive product which evolves HBr at room temp. or more rapidly at $60-70^\circ$, giving the compound, $B_3N_3H_2Br_4$ ("inorg. dibromobenzene"), which is readily hydrolysed to "inorg. resorcinol." H. W.

Magnesium carbides. W. H. C. Rueggeberg (*J. Amer. Chem. Soc.*, 1943, 65, 602—607).— MgC_2 is shown to be unstable at high temp., yielding free C and Mg_2C_3 . Mg_2C_3 is shown, by a variety of tests, to be a pure substance and appears to contain a 3-C chain in its crystal lattice. MgC_2 (prep. from $MgEt_2$ and C_2H_2) has been examined by the X-ray powder method; the data compare well with those for the tetragonal CaC_2 structure having a_0 4.86, c_0 5.76 Å. An explanation of the reactivity and instability of MgC_2 is advanced.

W. R. A.

Red zinc oxide. W. Ehret and A. Greenstone (*J. Amer. Chem. Soc.*, 1943, 65, 872—877).—Red ZnO can be prepared by heating white ZnO with NH_4 salts or $CO(NH_2)_2$ or NH_2Ac but the most suitable method is to heat white ZnO with NH_4NO_3 . The red oxide contains $\sim 0.02\%$ of Zn in excess and its colour val. is the higher the higher is the amount of excess Zn. The average particle size in the red oxide is $>$ in the solute but vals. of ρ and solubility are identical. The cause of coloration cannot be unequivocally stated but the presence of F centres is favoured.

W. R. A.

Fractionation of the rare earths by zeolite action. R. G. Russell and D. W. Pearce (*J. Amer. Chem. Soc.*, 1943, 65, 595—600).—Fractional separation of rare earths by zeolites has been effected. Rare earth ions of decreasing ionic radius are held more firmly in the zeolite lattice than larger ions. Removal of rare earth ions from the zeolite may be carried out fractionally, the largest ions being removed first.

W. R. A.

Hydrate isomerism in the hydrated chromic chlorides. Preparation of triethylenediaminechromic chloride from hexa-aquo-chromic chloride. L. E. Marchi and J. P. McReynolds (*J. Amer. Chem. Soc.*, 1943, 65, 480—481).— $[Cr(en)_3]Cl_3$, in yields $>25\%$ of theoretical yield, was prepared by action of dry $(CH_2NH_2)_2$ on $[Cr(H_2O)_6]Cl_3$ but not on $[Cr(H_2O)_4Cl_2]Cl \cdot 2H_2O$ or $[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$.

W. R. A.

Reactions of nickelous, nickelonickelic, and ferric oxides in liquid ammonia. R. B. Holt and G. W. Watt (*J. Amer. Chem. Soc.*, 1943, 65, 988—989).—All are insol. in and unreactive towards liquid NH_3 at 25° . Fe_2O_3 was unchanged after treatment with liquid NH_3 containing a large excess of NH_4Cl or NH_4NO_3 , whilst under similar conditions NiO dissolved to a slight extent and Ni_2O_3 gave large yields of $Ni(NH_3)_6X_2$ (X = NO_3 , Cl). Treatment with solutions of KNH_2 in liquid NH_3 gave unchanged NiO , a mixture of insol. products with Ni_2O_3 , and FeO and Fe with Fe_2O_3 . At 0° NiO is reduced to Ni by liquid NH_3 solutions of K. Ni_2O_3 and Fe_2O_3 catalyse the formation of KNH_2 from K in liquid NH_3 so that the oxides were not sensibly reduced.

W. R. A.

Formation of nickel and cobalt silicates with planar lattices. W. Feitknecht and A. Berger (*Helv. Chim. Acta*, 1942, 25, 1543—1547).—Heating of a suspension of pure $Ni(OH)_2$ in H_2O in a sealed glass tube at $\sim 200^\circ$ during 30 hr. yields a product incompletely sol. in HCl. The insol. portion has an approx. composition $5NiO \cdot 8SiO_2 \cdot 8H_2O$ and yields a characteristic X-ray diagram similar to that of other hydrated silicates, e.g., chamosite and antigorite.

The cell is orthohexagonal with a 5.33, b 9.24, c 7.25 Å. The structure seems to comprise alternate planes of $Ni(OH)_2$ and SiO_2 . When green basic Co bromide is heated with H_2O in a sealed tube at $\sim 200^\circ$ it yields a similar product with a 5.37, b 9.30, c 7.37 Å.

J. W. S.

X.—ANALYSIS.

Indicator having remarkable properties. G. Schwarzenbach (*Helv. Chim. Acta*, 1943, 26, 418—424).—The cation of 5-pyridinium-glutacondialdehyde perchlorate, $[O:CH \cdot CH:CH:CH:CH \cdot NC_5H_5]^+$ (A., 1943, II, 172), is a dibasic acid of which the acid-base system is of the type $A^+ + OH^- \rightleftharpoons B^- + H^+$. As an indicator its colour change covers a very small pH range, and the salt effect and alcohol error are also very small.

F. J. G.

Use of *p*-aminodimethylaniline as an indicator for free chlorine [in water].—See B., 1943, III, 164.

Colorimetric determination of ammonia with Nessler reagent. E. Geiger (*Helv. Chim. Acta*, 1942, 25, 1453—1469).—The reaction between NH_3 and K_2HgI_4 in alkaline solution attains an equilibrium state, being most complete at high $[KOH]$ and reversed by the addition of KI. In 2—12N-KOH at $18-70^\circ$ only Hg_2ONH_2I is pptd., whereas in 0.01—1N-KOH (Hg_2ONH_2I), HgI_2 is also pptd. and in 0.01—0.1N-KOH pptn. is not quant. For the colorimetric determination of NH_3 it is recommended that the solution under test should be brought to an alkali content of 0.105—0.135N. with NaOH or KOH and then treated with K_2HgI_4 reagent. The latter is made up so as to contain excess of HgI_2 , which can react with the KI formed in the reaction to yield further K_2HgI_4 .

J. W. S.

Perchloric acid method for determination of silicon in ferrosilicon.—See B., 1943, I, 297.

Detection of war gases. I. Dyes as reagents for detecting phosphene. T. L. Pu and C. T. Lo (*J. Chinese Chem. Soc.*, 1941, 8, 140—142).—72 dyes have been tested as reagents for $COCl_2$. Me-violet, Me-violet B, gentian-violet B, and rosaniline give colour changes with 0.7 mg. of $COCl_2$ per l. within 1 sec. (test papers exposed to vapour from 1% $COCl_2$ in PhMe).

A. Li.

Systematic analysis of the cations without the use of hydrogen sulphide. T. P. Chao and S. C. Hwang (*J. Chinese Chem. Soc.*, 1941, 8, 21—31).—In the system suggested the cations are separated into groups by successive pptns. with HCl, dil H_2SO_4 and EtOH, $(NH_4)_2S$ in presence of NH_4OAc and excess of AcOH, and H_3PO_4 and excess of aq. NH_3 . The separation and identification of the cations within each group are outlined in tables.

J. W. S.

Determination of potassium with zinc cobaltinitrite. Y. C. Chen and S. S. Shen (*J. Chinese Chem. Soc.*, 1941, 8, 12—14).—Zn cobaltinitrite reagent, prepared by the method of Adams *et al.* (A., 1935, 1337), can be used for the determination of K. The results are as satisfactory as those obtained by pptn. with $Na_3Co(NO_2)_6$ and the filtrate from the separation of K can be used for determination of Na by pptn. with Zn uranyl acetate.

J. W. S.

Removal of phosphate ions before determination of sodium by the zinc uranyl acetate method. Y. C. Chen and S. S. Shen (*J. Chinese Chem. Soc.*, 1941, 8, 7—11).—Both the $ZrOCl_2$ and Sn methods are suitable for the removal of PO_4^{4-} prior to the determination of Na by pptn. with Zn uranyl acetate in solutions containing 0.05—1 mg. of Na and 1.5 mg. of PO_4^{4-} per ml. in the presence of traces of K, Ca, or Mg. The $ZrOCl_2$ method is particularly efficient and rapid.

J. W. S.

Spectrochemical determination of potassium in brine solutions.—See B., 1943, I, 282.

Determination of calcium by precipitation with picrolonic acid and polarographic measurement of residual picrolonic acid. G. Cohn and I. M. Kolthoff (*J. Biol. Chem.*, 1943, 147, 705—719).—In the method described, dissolved Ca (conc. 0.001—0.01M.) is treated with excess of 0.01M-picrolonic acid (I) after addition of AcOH—LiOAc—LiCl buffer and the mixture is maintained for 12 hr. at 0° for $[Ca] > 5 \times 10^{-3}M.$ or at $> 20^\circ$ when it is higher. The excess of (I) is determined polarographically without removing pptd. Ca picrolonate. The error is 1—2%. The amount of (I) required is deduced by comparing the turbidity produced on adding oxalate to a portion of the solution with that produced in a standard Ca solution or by measuring the time before pptn. of Ca picrolonate begins. Relatively large concns. of Na^+ , K^+ , NH_4^+ , Mg^{2+} , SO_4^{2-} , and PO_4^{4-} do not interfere.

W. McC.

Determination of zinc in aluminium alloys.—See B., 1943, I, 302.

Electrolytic determination of zinc in magnesium alloys.—See B., 1943, I, 301.

Determination of zinc and cadmium cations with anthranilic acid. P. Wenger (*Helv. Chim. Acta*, 1942, 25, 1499—1500; cf. Funk, A., 1943, I, 42).—The micro-gravimetric determination of Zn by pptn. with anthranilic acid is equally accurate whether pptn. is brought

about at room temp. or at 100° but for determination of Cd more accurate results are obtained by pptn. at 100°. J. W. S.

Reagents for cations. VIII. Reagents for cerium cations. P. Wenger and R. Duckert [with (Mile.) Y. Rusconi] (*Helv. Chim. Acta*, 1942, 25, 1547—1552).—The disadvantages of various reagents which have been suggested for the detection of Ce are tabulated. The characteristics, sensitivities, and specificities of the following reagents recommended for use under various conditions are recorded: Na_2CO_3 , phosphomolybdic acid, benzidine or *o*-tolidine, $o\text{-NH}_2\text{C}_6\text{H}_4\text{CO}_2\text{NH}_4$, $\text{CHPh}(\text{C}_6\text{H}_4\text{NMe}_2\text{-}p)_2$. J. W. S.

Quantitative spectrographic analysis of stainless steels.—See B., 1943, I, 297.

Cobalt determination [in steel] by photo-electric comparison.—See B., 1943, I, 297.

Spot test for chromium [in steel].—See B., 1943, I, 297.

Determination of aluminium in high-nickel-chromium steels.—See B., 1943, I, 297.

Analytical study of thorium and cerium cations. P. Wenger and R. Duckert (*Helv. Chim. Acta*, 1943, 26, 416—418; cf. A., 1942, I, 410; also *supra*).—A correction. F. J. G.

XI.—APPARATUS ETC.

Weissenberg controlled-temperature technique. N. W. Buerger (*Amer. Min.*, 1942, 27, 217—218).—A heating accessory permits powder photographs of single crystals heated at various temp. to be taken. L. S. T.

Attempts at obtaining excitation of an atomic beam of monatomic hydrogen. W. E. Williams (*Rev. Mod. Physics*, 1942, 14, 94—95).—It was found possible to excite an at. beam of H by means of an oscillator (100 w., λ 5.2 m.) using an arrangement of 5 fore slits in parallel, and Hg diffusion pumps of 1000 l. per sec. pumping speed. The Hg spectrum, however, was also present, and the beam was only slightly brighter than the background. A. J. M.

Atomic beam light sources applied to the structure of the magnesium I resonance line. R. A. Fisher (*Rev. Mod. Physics*, 1942, 14, 79—81).—A spectroscopic source, making use of an at. beam produced in an electrodeless ring discharge in A, has been constructed, and was used to excite the resonance lines of Mg I and II. Examination of the structure of the Mg I resonance line λ 2852 Å. shows three resolved components corresponding to the three Mg isotopes 24, 25, 26, with abundance ratios 7 : 1 : 1. A. J. M.

Atomic beam apparatus for studying the atomic spectra of gases, especially hydrogen. J. E. Mack and E. C. Barkofsky (*Rev. Mod. Physics*, 1942, 14, 82—93).—An apparatus has been designed for the examination of H_a . Geometrical considerations affecting the construction of apparatus for this purpose are dealt with. In at. beam apparatus for use with gases, the pressure ratio of the final and initial chambers must be \ll the solid angle subtended by the first slit at a point in the field of view, and the region in which atoms are excited should not extend far beyond the full portion of the beam. The Doppler effect for a line emitted from an at. beam is considered and it is shown that five factors contribute to it, some of which produce broadening and others frequency shifts. It is possible to keep the broadening low enough to obtain complete resolution of the electronic structure of H_a . A. J. M.

Application of atomic beams in spectroscopy. K. W. Meissner (*Rev. Mod. Physics*, 1942, 14, 68—78).—The advantages of at. beams in spectroscopy, particularly in reducing the width of spectral lines without the use of low temp., are considered. The construction of at. beam apparatus for use in the absorption, fluorescence, and electron impact methods is described. The applications of the method to intensity distribution in lines, fine structure, hyperfine structure, the Zeeman effect of hyperfine structure, and the inverse Stark effect are reviewed, and some further applications are indicated. A. J. M.

Infra-red prism spectrograph as a precision instrument. R. A. Oetjen, C. L. Kao, and H. M. Randall (*Rev. Sci. Instr.*, 1942, 13, 515—523).—The working conditions of a modified recording spectrometer of the Randall and Strong type (cf. A., 1931, 1387) have been examined. The max. speed of operation is determined by the response characteristics of the recording apparatus. Changes of $\sim 0.5^\circ$ in the prism temp. cause appreciable errors in λ measurements, and temp. control or correction for temp. changes is essential. Mechanical imperfections render calibration tests necessary at frequent intervals. Calibration by comparison with grating spectra should be carried out with data obtained at a resolution equal to that of the prism instrument; the fine structure of absorption bands of CO_2 (15.4—13.9), NH_3 (14.0—7.9), and H_2O (7.9—5.0 μ) has been examined at a resolution suitable for calibration of a NaCl prism, and 150 sharp calibration points are listed. The accuracy attained is $\pm 0.001 \mu$. at 15 μ ., or $\pm 0.005 \mu$. at 5 μ . A. J. E. W.

Carbon arc in oxygen for the spectrochemical determination of potassium. L. T. Steadman (*Physical Rev.*, 1943, [ii], 63, 322, 399).—The adverse effect of the high background and the lines of CN bands due to atm. N_2 is remedied by a partial replacement of N_2 by O_2 . A technique is described, and its use in the analysis of blood serum is indicated. N. M. B.

Application of the Hirschmüller-Bechstein photoelectric colorimeter to steel analysis.—See B., 1943, I, 297.

Photoelectric spectrophotometer for analytical research. D. E. Howe (*Iowa State Coll. J. Sci.*, 1942, 17, 82—84).—The design of a spectrophotometer giving results of the same order of accuracy as a commercial instrument but being simpler, smaller, less expensive, and requiring less highly trained operators for manipulation is described. J. W. S.

Slotted cylindrical rotors for photometric calibration. J. R. Platt, H. E. Clark, A. A. Cohen, and P. A. Caldwell (*Rev. Sci. Instr.*, 1943, 14, 85—88).—The use of hollow cylindrical rotors with slotted walls as substitutes for sector discs for some photometric applications is described, designs for rotors which can replace a logarithmic sector, fixed sector disc, step sector, and variable sector disc being given. A rotor corresponding with the latter and adjustable inside a vac. system has been constructed. J. L. E.

Method of preparing strips with uniformly varying blackening. E. S. Barr and L. B. Scott (*Rev. Sci. Instr.*, 1942, 13, 533—534).—A strip of sensitised film is supported on a curved surface designed to give a suitable continuous variation of the angle of incidence of a parallel beam of light. An equation is given for the curve required for a linear variation of blackening. A. J. E. W.

Monochromator using a large water prism. C. V. Cannon and O. K. Rice (*Rev. Sci. Instr.*, 1942, 13, 513—514).—The inexpensive instrument described employs a constant-deviation, totally-reflecting H_2O prism built from quartz plates, with a massive metal frame to minimise temp. gradients. A. J. E. W.

Supermicroscopy with a reaction chamber, using the universal electron microscope. M. von Ardenne (*Z. physikal. Chem.*, 1942, B, 52, 61—71).—The construction of a reaction chamber which can be used with the universal electron microscope is described. With its aid it is possible to examine objects under pressure, and the effect of gases on substances can also be followed. A. J. M.

Temperature-controlled X-ray powder camera. M. J. Buerger, N. W. Buerger, and F. G. Chesley (*Amer. Min.*, 1942, 27, 217). L. S. T.

Differential polarography and polarometry. G. Semerano and L. Riccoboni (*Gazzetta*, 1942, 72, 297—304).—Many of the difficulties of polarography are avoided by employing two identical dropping electrodes in parallel and two solutions, identical except that one only contains the substance (I) being determined. A recording galvanometer is connected across the two circuits, and records only the depolarisation current due to (I), eliminating effects due to O_2 or other substances (even in quantities which would make normal polarography impossible), or to external causes; except when the drops from the two electrodes are out of phase, and a sensitive galvanometer is employed, a continuous graph is obtained. A polarometric method is proposed, based on quant. addition of (I) to the control solution until the displacement due to its presence in the other is eliminated. E. W. W.

Determination of half-value periods from observations with a single Geiger counter. A. G. Ward (*Proc. Roy. Soc.*, 1942, A, 181, 183—197).—The coincidence circuit described makes possible the determination of half-val. periods between 10^{-4} and 1 sec. by the use of a single Geiger counter. The periods of Ac-A, Th-A, and Ra-C' have been determined. The limitations and sources of error of the method are discussed. G. D. P.

High-temperature stopcock greases. I. E. Puddington (*J. Amer. Chem. Soc.*, 1943, 65, 990—991).—Stopcock greases composed of 15—25% of Li or Al stearates in mineral oil are described. W. R. A.

Tyre valve in vacuum application. C. H. Bachmann and I. B. Bensin (*Rev. Sci. Instr.*, 1942, 13, 534—535).—The valve is operated by an extension wire welded to the high-pressure side of the valve rod, or by a lever acting through vac.-tight bellows. A. J. E. W.

Laboratory liquid air storage. J. R. Roebuck (*Rev. Sci. Instr.*, 1943, 14, 90—97).—The design and construction of a 120-l. triple-wall, Ag-plated, metal vac. vessel for containing liquid air are described. The radiation theory for its part of the evaporative loss has been worked out, the calc. loss being in agreement with the observed loss of 3 kg. per day. J. L. E.

XIII.—GEOCHEMISTRY.

Gold content of the sea. W. Stark (*Helv. Chim. Acta*, 1943, 26, 424—441).—The waters of the Adriatic, the Mediterranean, and the

Atlantic contain respectively 0.02, 0.4, and 2.0 mg. of Au per cu. m. A sample of seaweed contained 0.17 mg. of Au per 1000 g. of dry material. F. J. G.

Separation of electricity in clouds. (Sir) G. C. Simpson (*Phil. Mag.*, 1943, [vii], 34, 285—287).—A reply to Chalmers (cf. A., 1943, I, 104). L. J. J.

Wind-borne dust collected in May, 1942. A. Sen (*Current Sci.*, 1943, 12, 55).—Mechanical and chemical analyses of dust from dust-storms, collected in Delhi, are given. The dust appears to be soil from a very arid zone. A. J. M.

Interior of the earth viewed in relation to earthquake causes. II. What radioactivity tells us about the interior of the earth. V. F. Hess (*J. Appl. Physics*, 1943, 14, 116—120).—Recent estimates of the total radioactivity of the earth's substance are reviewed. The observed γ -ray ionisation in ionisation chambers placed over land and water is $>$ that calc. from Evans and Goodman's radioactivity data. L. J. J.

Origin of sulphides in the nickel deposits of Mount Prospect, Connecticut. E. N. Cameron (*Amer. Min.*, 1942, 27, 218).—The ores are noritic and pyroxenitic rocks containing varying amounts of pyrite, pyrrhotite, pentlandite, and chalcopyrite. The sulphides are probably of magmatic or late magmatic origin, and have been formed chiefly by fracture filling and by replacement of the various silicates. L. S. T.

Distribution of trace elements in the rocks of the Skaergaard intrusion, Greenland. L. R. Wager and R. L. Mitchell (*Min. Mag.*, 1943, 26, 283—296).—Spectrographic analyses were made for a no. of elements in the olivine-gabbro representing the original magma and in the series of rocks (gabbro-picrite, olivine-gabbro, ferrogabbro, basic hedenbergite-granophyre, and acid granophyre) produced by fractional crystallisation. The undifferentiated olivine-gabbro gave results agreeing with an average gabbro except that Sr is ten times more abundant. Cr and Ni tend to be conc. in the earlier basic differentiates, V and Co in the early middle, Cu and Li in the late middle, whilst Mo, Zr, Th, La, and Rb are conc. in the latest differentiate, the acid granophyre; Ba shows a continuous and marked increase in amount throughout the whole range of the differentiation series. L. J. S.

Brammallite (sodium-illite), a new mineral from Llandebie, South Wales. F. A. Bannister (*Min. Mag.*, 1943, 26, 304—307).—White coatings on coal-measure shales consist of tufts of minute flakes, with n a 1.561, γ 1.579, and X-ray spacings a 5.2, b 9.0, c sin β 19.2 Å., and containing Na₂O 5.22, K₂O 2.58%. These data are compared with those for paragonite, illite, muscovite, and hydromuscovite. L. J. S.

Rare occurrence of melilite-diopside-nepheline association in a calciphyre near Nanjangud, Mysore. B. R. Rao (*Current Sci.*, 1943, 12, 54).—The occurrence of melilite and nepheline in calciphyres in Mysore has been discovered. This throws some light on the mode of origin of the melilite rocks, which seem to have been formed, in this region, from reactions between an older, impure, dolomitic limestone and later injected alkaline liquids connected with granitic inclusions. A. J. M.

Lead-uranium-thorium ratios of various zones of a single crystal of uraninite from Spruce Pine, N. Carolina. C. M. Alter and E. S. McColley (*Amer. Min.*, 1942, 27, 213).—Analyses for Pb, U, Th, and acid-insol. material from the outer and middle zones, and the core, are given. The ratios Pb/(U + 0.36Th) are 0.0471, 0.0486, and 0.0503, respectively, corresponding with approx. ages of 358, 369, and 382×10^6 years. L. S. T.

Chromite deposits of the Philippine Islands. D. F. Frische (*Amer. Min.*, 1942, 27, 221).—The deposits occur in isolated masses of ultra-basic rocks, which are highly serpentinised and are composed essentially of dunite, saxonite, and pyroxenite rock types. The commercially-important deposits appear to be confined to the serpentinised dunite. Gabbro and diorite intrude the deposits locally, but are confined to the ore bodies of refractory grade. The chromite (I) is considered to be genetically related to the dunite, and is probably of early magmatic origin. Philippine reserves of all grades of (I) are estimated to be 10,890,500 m. tons. L. S. T.

Analysis and age of monazite from Deer Park No. 5 mine, Spruce Pine, N. Carolina. A. D. Bliss (*Amer. Min.*, 1942, 27, 215).—The monazite contains Th 4.81—4.86, Pb 0.131—0.134%, and, possibly, U 0.01%. The calc. age is 6×10^8 years. L. S. T.

Scheelite deposits in the Greenhorn mountains of the Southern Sierras. N. C. Dale (*Econ. Geol.*, 1942, 37, 84—85). L. S. T.

Tin deposits of Carguaicollo, Bolivia. F. S. Turneure and R. Gibson (*Econ. Geol.*, 1942, 37, 84). L. S. T.

Clay minerals in recent marine sediments. R. S. Dietz (*Amer. Min.*, 1942, 27, 219—220).—The clay fractions of 39 sediments from the various oceans of the world have been investigated. The particles of the red clay samples are coarser than those of the green and blue muds which, in turn, are usually coarser than clays in tidal estuaries, bays, inland seas, river sediments, and soil clays. Marine clays probably undergo a post-depositional increase in grain size. X-Ray and petrographic examinations show that illite (I), kaolin (II), and montmorillonite (III) are also the main constituents of marine clays, with (I) predominating. Small amounts of (III) occur in near-shore sediments, but not in those from the deep sea. (II) and (III) are formed on the sea floor by the alteration of the feldspars in granite. (II) may form by the alteration of some primary minerals and especially by alteration of (III); this change involves adsorption of K from sea-H₂O into (III), and may, *inter alia*, account for the low K : Na ratio in sea-H₂O as compared with that of river-H₂O. L. S. T.

Nature and origin of the Edwin clay, Lone, California. T. F. Bates (*Amer. Min.*, 1942, 27, 214).—This clay is a highly refractory kaolin clay used for manufacturing firebricks. It has been formed from laterite. L. S. T.

Nature of Georgia kaolin. I. Chemical and colloidal analysis. II. Mineralogical analysis. L. Mitchell and E. C. Henry (*J. Amer. Ceram. Soc.*, 1943, 26, 105—113, 113—119).—I. The clays are sedimentary Cretaceous kaolins, probably deposited in off-shore lakes where salt and fresh H₂O met. All are rich in Al₂O₃ and deficient in SiO₂ beyond the kaolinite ratio. The low Fe₂O₃ and MgO contents indicate that the clays do not contain montmorillonite (with one exception where it is a contaminant) but are essentially kaolinitic. The morin dye test for Al⁺⁺⁺ indicates that some of the clays (particularly the hard varieties) release the ions more readily than others, probably due to the presence of halloysite or perhaps imperfectly cryst. kaolinite. The soft clays are more readily electrolysed than the hard clays, and much more so than bentonite or fuller's earth. The soft clays have a larger grain size than the hard clays. The viscous behaviour of the clay slips is not well correlated with the hardness owing to the peculiar distribution of grain size, the grain shape, and the presence and nature of the org. matter. Soft kaolins have the lowest and the hard kaolins the highest base-exchange vals.

II. Thermal and X-ray analyses confirm that the soft kaolins contain a high proportion of cryst. kaolinite whereas the hard clays contain less well-cryst. material. The degree of crystallisation, grain size, the nature and amount of the org. matter, and the admixture of different minerals explain the different behaviour of the clays. J. A. S.

Dehydration study of clays. L. H. Berkelhamer (*J. Amer. Ceram. Soc.*, 1943, 26, 120—126).—20 clays were dehydrated at 300° to a const. wt. and then rehydrated by exposure to a H₂O-saturated atm. at 30° for 28—80 days. After 10 hr. of rehydration the montmorillonite (I) and halloysite (II) clays showed marked hydration whilst the kaolinite clays had rehydrated to the same extent (6%) only after ~1000 hr., by which time (I) had rehydrated to ~36%. (II) were distinguished from (I) by the fall in rate of rehydration after 50 hr. (II) was saturated after 1000 hr. but the other clays were still rehydrating after 1000 hr. and after 1500 hr. in some cases. A test made by dehydration of duplicate samples at 300°, followed by a 2-hr. rehydration period at 65° for one sample and a 2-hr. dehydration period at 600° for the other sample, is a quick (5 hr.) and simple method of identifying the main clay mineral types. J. A. S.

Stratigraphical arrangements and occurrence of torbanite deposits in the Upper Kamlaroi coal measures of New South Wales. J. A. Dulhunty (*Proc. Linnæan Soc. N.S. Wales*, 1942, 67, 123—141).—The deposits occur interbedded with the coal measure sediments as isolated lenticular seams the lateral extent of which varies from 6 miles to <0.5 mile. The association of torbanite with bituminous and cannel coals is described. The palæogeographical distribution of the torbanite deposits and their relation to coal-measure stratigraphy are dealt with. The individual deposits are described in detail and proximate analyses given. R. B. C.

Mica of certain coal-measure shales in South Wales. G. Nagelschmidt and D. Hicks (*Min. Mag.*, 1943, 26, 297—303).—Chemical analyses are given of six shales overlying anthracite and bituminous coal, and of the fine fractions separated from each. These and X-ray analysis show that the fine fractions contain illite with ~10% of kaolin and 1% of quartz. Dehydration, optical, and base-exchange data are also given, and the conditions of formation and stability of illite are discussed. The Na content of illite decreases slightly with decreasing rank of the associated coal, suggesting that anthracite was formed under alkaline conditions. L. J. S.

A., I.—General, Physical, and Inorganic Chemistry

SEPTEMBER, 1943.

I.—SUB-ATOMICS.

Atomic beams in spectroscopy.—See A., 1943, I, 209.

Zeeman effect of the spectrum of singly-ionised argon in fields of 55,000 Gauss. R. Bezler (*Z. Physik*, 1940, **116**, 480—494).—The Zeeman effect of 81 A II lines has been investigated, with a field of 55,000 gauss. Some very narrow, formerly unresolved Zeeman lines, and further anomalous *g*-vals., have been observed, especially with the $4d^4D_4(3p)$ term. A. J. M.

Zeeman effect in xenon spark spectrum, Xe II. I. H. Angenetter (*Z. Physik*, 1939, **114**, 636—650).—Data are recorded for 32 classified and 45 unclassified spark lines of Xe between 3811 and 6344 Å. L. J. J.

Determination and explanation of the limits of layers emitting sodium fluorescence radiation in evening light. G. Cario and U. Stille (*Z. Physik*, 1940, **116**, 122—136).—The height of 60 km. found by Bernard (A., 1938, I, 543) for the layer of glowing Na is only a min. val. for the upper limit, obtained by supposing that the troposphere is perfectly transparent to light. If absorption in the troposphere is taken into account, the upper limit for the height of the glowing Na layer is calc. to be 78 km., the lower edge being at 69 km. A. J. M.

Influence of concentration on the intensity of spectral lines in the spark. F. de Boer (*Z. Elektrochem.*, 1940, **46**, 591—594).—Measurement of the intensities (*I*) of the lines in the spark spectra of Pb-Sn alloys shows that the relation $\log I = a \log c + b$ (*c* = concn., *a* and *b* are consts.) approaches a simpler form with *a* = 1 at low vals. of *c*. Deviations of *a* from unity are attributed to absorption in the vapour. The ratio of the concns. of the metals in the vapour is approx. that in the electrodes, no distillation effect being observed. Similar results are obtained with Sn in Ag or Cd and for Cd in Zn. J. W. S.

Distribution of the intensities of spectral lines over the path of the spark. F. de Boer (*Z. Elektrochem.*, 1940, **46**, 594—595).—The relative intensities of various Sn and Pb spectral lines have been measured during the passage of sparks between electrodes of pure Sn and of Sn containing 7 at.-% of Pb. The average intensity of the Pb lines over the whole path when the alloy is anode is ~40% > when it is the cathode. The variation of the relative intensities of various Pb lines along the path of the spark can be explained by assuming that the outer vapour shell of the spark comprises mainly material from the anode, which is the hotter electrode. J. W. S.

Continuous spectrum of the carbon arc light. II. H. Maecker (*Z. Physik*, 1940, **116**, 257—266; cf. A., 1940, I, 183).—The construction of a stabilised C arc in a quartz tube 10 mm. in diameter, filled with N₂, is described. A current of 30—50 amp. and a c.d. of 2600 amp. per sq. cm. were obtained. The temp. was 13,000° K. and the electron pressure 60 mm. The continuous spectrum of the arc light was investigated. The variation of the absorption coeff. with λ and temp. was examined, and its abs. val. determined. The experimental curve is similar in shape to the theoretical curve for the absorption coeff. of free electrons, but the latter is somewhat flatter. A. J. M.

B.p. of carbon and the high-current arc. E. Podszus (*Z. Physik*, 1940, **116**, 352—358).—The characteristics of high-current arcs are discussed. A. J. M.

So-called minimal arcing potential. P. Rossbach and R. Seeliger (*Z. Physik*, 1940, **116**, 68—72).—It is pointed out that the min. arcing potential, i.e., the smallest potential under which it is possible to maintain an arc between given electrodes, can be determined by the usual method to an accuracy of only 1 v. It represents the sum of the anode and cathode drops. A. J. M.

Calculation of the eigenfunction and energy of the ground state of the valency electrons in alkaline-earth atoms. P. Gombás (*Z. Physik*, 1940, **116**, 184—193).—A method formerly described (A., 1940, I, 149) is used to calculate the eigenfunction and energy of the valency electrons of the alkaline-earth atoms in the ground state. For the Ca atom, the calc. vals. of the first and second ionisation energies are 5.78 and 11.19 e.v. A. J. M.

Experimental test of the wave-mechanical theory of field electron emission. R. Haefer (*Z. Physik*, 1940, **116**, 604—623).—Former

investigations of the field electron emission from points have been difficult on account of an incomplete knowledge of the true form of the point, but this can now be obtained by means of the electron microscope. W points were used with a field strength of 3×10^7 v. per cm. The wave-mechanical theory was confirmed for pure W. Theory requires that the c.d. should be \propto (emission work)^{1.5}. Deviations from this for Ba adsorbed on W are due to an increase in the field strength on account of crystallite formation. The wave-mechanical theoretical results can also be verified for crystallite-free, electron-microscopically controlled layers of Ba, K, and Cs. A. J. M.

Electronics of natural cleavage surfaces of metallic single crystals. I. Formation of cleavage surfaces of single crystals of zinc in a high vacuum and preliminary photo-electric measurements. W. Kluge and H. Steyskal (*Z. Physik*, 1940, **116**, 415—427).—The cleavage of a single crystal of a metal in a high vac. provides a method of determining the effect of crystal orientation on the electronic properties of various boundary surfaces. The effect of secondary structure and impurities is discussed. A method is described for determining the photo-emission of a (0001) face of a Zn single crystal. The λ limit of the photo-effect is $\lambda_0 = 290 \pm 0.7 \mu\mu$, and the val. of the emission work-function is 4.26 e.v. A. J. M.

Internal motion of the electron. III. H. Hönl and A. Papapetrou (*Z. Physik*, 1940, **116**, 153—183; cf. A., 1939, I, 394; 1940, I, 185).—Theoretical. The relationship between the Dirac electron and polar-dipolar particles is investigated. The details of macro- and micro-motion of the electron, the characteristic impulse moment, and the energy function are obtained. The polar-dipolar particle may be regarded as the classical model of the Dirac electron. A. J. M.

Theory of electronic plasma vibrations. R. Seeliger (*Z. Physik*, 1942, **118**, 618—623).—Mathematical (cf. Tonks and Langmuir, A., 1929, 1369). W. R. A.

Significance of ternary collisions in energy relations of discharges in gases. R. Rebsch (*Z. Physik*, 1939, **114**, 620—635).—The energy transfer between two electrons colliding in the presence of a neutral atom is derived from wave-mechanical principles. The energy relations of discharges in gases still present difficulties even if such ternary collisions are taken into account. L. J. J.

Cathodic sputtering by oblique ionic bombardment. H. Fetz (*Z. Physik*, 1942, **119**, 590—601).—Sputtering of thin wires by ions of long free-path increases rapidly with decreasing thickness of the wire, owing to the greater sp. effect of oblique impact. L. J. J.

Physical chemistry of a cooling planet. P. G. Nutting (*J. Washington Acad. Sci.*, 1943, **33**, 121—125).—A tentative sketch of the stages of the probable early physical history of the earth on a temp. instead of a time scale, based on known data (m.p., b.p., crit. temp. and pressure) for the materials composing its surface. N. M. B.

Behaviour of hydrogen bromide in nuclear processes of bromine.—See A., 1943, I, 206.

Artificial radioactive isotopes of lead and neighbouring elements, produced from uranium and thorium lead. W. Maurer and W. Ramm (*Z. Physik*, 1942, **119**, 602—629).—3.3-hr. ²⁰⁹Pb, from ²⁰⁹Bi (*n, p*) and ²⁰⁸Pb (*n*), has target area 10^{-27} sq. cm. for addition of thermal neutrons and a greater val. for fast neutrons, and emits electrons of 750 ke.v. without γ -radiation. 52-hr. ²⁰³Pb, from ²⁰⁴Pb (*n, 2n*), is not formed with neutrons < 5.3 Me.v.; it emits β -radiations of 180 and 330 ke.v. by internal transformation of two γ -quanta of 270 and 420 ke.v., and strong γ - and X-radiations. 68-min. ²⁰⁴ or ²⁰⁵Pb, from ²⁰⁴Pb with unretarded (*Li + α*) neutrons, has target area $< 7 \times 10^{-28}$ sq. cm. for addition of thermal neutrons. It emits several β -lines up to 750 ke.v. and γ -radiation up to 900 ke.v. ²⁰⁹Bi absorbs fast neutrons, and thermal neutrons with target area 10^{-27} sq. cm. 13-day ²⁰²Tl emits strong X-radiation of ~70 ke.v., and γ -radiation of 400 ke.v. 5.5-min. ²⁰⁵Hg is formed from ²⁰⁵Tl (*n, p*) and ²⁰⁸Pb (*n, α*). 30—60-day ²⁰³Hg is formed from Tl (*n, p*). 48-min. ^{200, 202}Au is formed from ^{205, 203}Tl (*n, α*) and from Hg (*n, p*). L. J. J.

Energy threshold of disintegration neutrons from uranium. W. Bothe and W. Gentner (*Z. Physik*, 1942, **119**, 568—574).—The energy spectrum of neutrons emitted from U disintegrated by

thermal neutrons from the ^{14}N (n, α) reaction is shown by a photographic method to extend to slightly >10 Me.v. L. J. J.

Nuclear structure of the elements. L. H. Sensicle (*Chem. and Ind.*, 1943, 234—235).—The suggestion previously advanced (A., 1943, I, 79) for a nuclear model based on the equilateral triangle, one edge of which represents an electron, and two a proton, is extended. As the periodic table is ascended, some nuclei may be given alternative model structures, involving principally the icosahedron. It is shown how isotopes of U can be built up in this way. The single icosahedron type of model is present in Fe, Ni, and Co, and it is suggested that on this account atoms of these elements have a preferred axis of rotation. This tends to fix the axis of revolution of the orbital electrons, and is characteristic of ferromagnetic elements. The structure of Er is also discussed. A. J. M.

Nuclear isomerism of strontium. H. Reddemann (*Z. Physik*, 1940, 116, 137—143; cf. A., 1940, I, 383).—The product from pure ^{87}Sr irradiated with neutrons, with half-life 3 hr., is identified with a radioactive isomeric form of stable ^{87}Sr . The effective cross-section of the reaction $^{87}\text{Sr}(n, n')^{87}\text{Sr}$ has been obtained for D + D neutrons. A. J. M.

Electrical quadrupole moment of the iodine nucleus. K. Murakawa (*Z. Physik*, 1939, 114, 651—652; cf. A., 1939, I, 290).—A correction. L. J. J.

Solar half-day period of cosmic rays at the equator. W. Rau (*Z. Physik*, 1940, 116, 105—114).—The twice-daily variation in intensity of the hard components of cosmic rays, found in the ocean, has been confirmed by experiments [by H. Hoerlin] carried out in the Peruvian mountains, near the equator. The amplitude of variation is $\pm 0.8\%$, and the phase agrees with that found in experiments carried out at a depth of 40 m. of H_2O . The layers in the upper atm., in which the mesotrons of the hard components are produced, must undergo a twice-daily variation, so that the mesotrons have different path-lengths. A. J. M.

Cloud chamber investigations with hard secondary radiation from cosmic rays. S. Liesegang (*Z. Physik*, 1940, 116, 515—524).—The hard secondary rays liberated from Pb by cosmic rays have been investigated. It is shown that the second max. at ~ 30 cm. Fe (~ 20 cm. Pb), observed by Maass, is produced by non-ionised particles, which are converted into ionised particles in the secondary radiation. A. J. M.

Observations of showers in air and nuclear fissions with cosmic rays in the ionisation chamber. H. Euler (*Z. Physik*, 1940, 116, 73—104).—The theory of extended showers in air is compared with the observation of Hoffmann collisions in an uncovered ionisation chamber. The larger collisions in the Hoffmann effect can be quantitatively explained as the effect of air showers, if assumptions are made concerning the energy of electrons in space. The effect of temp. and pressure on these collisions is calc. The smaller collisions cannot be explained as the result of air showers, but correspond to nuclear fission brought about by cosmic rays. The small frequency of air showers provides evidence for the view that the electrons observed at sea level are not produced by a cascade effect from the electrons of space, but by secondary processes from the hard radiation. A. J. M.

Cascade theory with collision loss. H. J. Bhabha and S. K. Chakrabarty (*Proc. Roy. Soc.*, 1943, A, 181, 267—303).—Subject to certain assumptions, a solution of the cascade equations is given in the form of a series which is so rapidly convergent that in general it is necessary only to calculate the first term. This term alone gives to a high degree of accuracy the whole energy spectrum of electrons from the highest energy to energies below the crit. level. G. D. P.

Liberation of single secondary electrons by mesotrons and electrons. E. Stuhlinger (*Z. Physik*, 1940, 116, 281—297).—Wilson photographs indicate that of 100 mesotrons, ~ 10 liberate one or more secondary electrons of energy $< 10^4$ e.v. when passed into a Pb sheet 9 mm. thick. About the same no. of electrons were liberated from a similar Al sheet. $\sim 75\%$ of the light electrons rich in energy are doubled or quadrupled when passed into a 9-mm. Pb sheet. Experiments with counter tubes give somewhat smaller nos. of secondary electrons liberated by mesotrons, and show that the no. produced in a Pb sheet is $<$ that produced in an Al sheet of mass-equiv. thickness. The no. of secondary electrons is compared with the theoretical val. of Bhabha, the energy spectrum of mesotrons obtained by Blackett being employed. A. J. M.

Thermodynamic method for Planck's radiation law. E. Lohr (*Z. Physik*, 1940, 116, 454—468).—Theoretical. It is shown that the supposition of the coexistence of a "radiation gas" with radiation leads to the Rayleigh-Jeans radiation law. The "radiation gas" is then replaced by a gas mixture, and the Planck law is deduced. A. J. M.

Quantum-mechanical treatment of atomic collisions. E. Lindholm (*Naturwiss.*, 1942, 30, 533—534).—Mathematical. L. J. J.

Origin of gravitational field. E. Reichenbächer (*Z. Physik*, 1942, 119, 630—658).—Theoretical. The author's non-relativistic theory

leads to the Newtonian law and the Einstein effect as first and second approximations, respectively. L. J. J.

Gravitational effects between polar-dipolar particles. A. Papapetrou (*Z. Physik*, 1940, 116, 298—309).—The gravitational force between two macroscopic polar-dipolar particles at rest has been calc. If the particles are widely separated the mean attraction is identical with the Newtonian attraction between simple mass poles. The momentary val. of the gravitational force, however, shows considerable variations about this mean val., owing to the internal motion of the particle. A. J. M.

II.—MOLECULAR STRUCTURE.

Intensity distribution in the quartet-doublet bands. I. A. Budó and I. Kovács (*Z. Physik*, 1940, 116, 693—700).—Theoretical. The intensity distribution in the branches of the inter-combination bands $^4\Sigma^+-^2\Sigma^+$, $^4\Sigma^+-^2\Sigma^+$, $^4\Sigma^+-^2\Pi(a)$, and $^4\Sigma^+-^2\Pi(b)$ is calc. A. J. M.

Explanation of perturbations in the nitrogen bands. L. Gerö and R. Schmid (*Z. Physik*, 1940, 116, 246—248).—Perturbations in the N_2 and N_2^+ bands can be explained by taking nuclear spin into account. The usual J -quantum no. is replaced by the corresponding total rotational impulse quantum nos. The Zeeman effect observed by Parker (A., 1933, 879) with perturbed N_2^+ lines can also be simply explained by introducing nuclear spin. A. J. M.

Rotational analysis of the IV positive bands of the nitrogen molecule. L. Gerö and R. Schmid (*Z. Physik*, 1940, 116, 598—603).—An analysis of the bands λ 2351 Å. (0—1) and λ 2448 Å. (0—2) of the $D-B^3\Pi$ system of N_2 is given. The bands consist of 15 branches, of which 5 are edge-forming. The lines show intensity variations within the branch. For even rotational quantum nos., the S_1 , Q_1 , R_2 , P_2 , Q_3 , and O_3 lines are the strongest. The rotational consts. for the $D^3\Sigma_u^+$ state of N_2 are $B_0 = 1.961 \text{ cm}^{-1}$ and $D_0 = 2 \times 10^{-5} \text{ cm}^{-1}$. A. J. M.

Formation of molecules in binary collisions. I. Aluminium hydrides. G. Stenvinkel (*Z. Physik*, 1939, 114, 602—619).—The spectrum of AlH obtained by heating Al in H_2 by means of an electric furnace shows enhanced intensity in the lines which are missing in the arc spectrum. This anomaly depends on the time elapsed since the beginning of the experiment, and the temp. and pressure in the furnace. A continuous spectrum is obtained at sufficiently high temp. and pressure. These effects are explained by the formation of AlH in the $^1\Pi$ state by binary collisions. L. J. J.

Completion of the term scheme of lead hydride. L. Gerö (*Z. Physik*, 1940, 116, 379—384).—Perturbations in the PbH spectrum have been investigated, and the anomalous behaviour of the rotation consts. of the initial term of the $^2\Sigma \rightarrow ^2\Sigma$ bands is ascribed to $\Delta\Lambda = 0$ perturbations. Investigation of the possibility of dissociation shows that the excited PbH terms cannot be dissociated in the at. terms of the Pb fundamental electron configuration. A. J. M.

Ultra-violet radiation of a non-self-dependent gas discharge. W. Schwiecker (*Z. Physik*, 1940, 116, 562—575).—An apparatus involving a counter tube has been used to investigate the properties of the ultra-violet radiation from a non-self-dependent gas discharge in air and H_2 , using plane electrodes. The intensity of various λ regions of the radiation has been determined. The absorption coeff. of the radiation in the gas was also obtained. $< 90\%$ of the radiation has $\lambda < 1000$ Å. The absorption coeff. in air is $\sim 0.4 \text{ cm}^{-1}$ (200 mm. pressure) or $\sim 1.5 \text{ cm}^{-1}$ (760 mm. pressure). In H_2 the absorption coeffs. are about half these vals. A. J. M.

Combination frequencies in the electronic-vibrational spectrum of rare earth salts. K. H. Hellwege and A. Roeber (*Z. Physik*, 1939, 114, 564—570).—A no. of weak lines in the absorption spectra of rare earth salts at 20°K . are identified with superposition of combinations of different anharmonic lattice vibrations on a single electronic transition. L. J. J.

Ion association and absorption spectrum. III. H. von Halban and M. Litmanowitsch (*Helv. Chim. Acta*, 1943, 26, 771—788).—The deviations from Beer's law for solutions of picric acid (I) in moist dioxan (II) decrease with increasing degree of purification of (II), and their dependence on the concn. of (I) or of added mineral acid suggests the presence of a basic impurity. The observed absorption spectra are compounded of those for undissociated (I) and for associated ion pairs of H_3O^+ and the ion of (I) (cf. A., 1941, I, 237). F. J. G.

Absorption spectra of explosives.—See B., 1943, I, 348.

Structure of sodium borate glasses as affected by temperature. A. E. Badger, H. C. Johnson, and J. O. Kraehenbuehl (*J. Amer. Ceram. Soc.*, 1942, 25, 395—401).—Spectral transmission curves were determined for $\text{Na}_2\text{O}-\text{B}_2\text{O}_3$ glasses containing 0—30% of Na_2O and coloured with 0.1% of Co_3O_4 at temp. up to the softening point. An abrupt rate of change of transmission with temp. occurred at or near the transformation temp., and a clearly defined

break occurred in the property-composition curve at ~15% of Na_2O . Theoretical deduction indicates that glasses containing 10 and 20% of Na_2O correspond with stable configurations. K_2O - B_2O_3 glasses show similar changes. The use of colour indicators to show changes in the high-temp. structure of glasses is a reliable method. J. A. S.

Absorption lines of water vapour in the spectral wave-length range 0.15–0.5 μ . H. Hopf (*Z. Physik*, 1940, 116, 310–316).—A spectrophotometer for the long- λ infra-red has been constructed. It can be used for determinations in the range 150–400 μ , with a slit-width of 18 μ . Individual lines in the absorption spectrum of H_2O vapour in this range have been investigated. The max. occur at 220 and 325 μ , and there are min. at 212 and 304 μ . A. J. M.

Absorption of liquid water and deuterium oxide in the infra-red region between 5 μ . and 27 μ . M. Sohm (*Z. Physik*, 1940, 116, 34–46).—The absorption spectra of H_2O and D_2O in thin layers have been determined in the near infra-red. For H_2O , the absorption gradually increases from 10 to 15 μ , after which there is a regular series of absorption max. The absorption curve for D_2O is similar to that for H_2O , but there is a displacement of the intramol. vibration bands to longer λ , indicated by the fact that the regular series of absorption max. does not begin before 19 μ . The separation of these max. (41 cm^{-1}) is somewhat < that for H_2O (52 cm^{-1}). If the mol. is capable of free rotation the separation in the case of D_2O should be approx. half that in the case of H_2O . The absorption spectrum of liquid H_2O shows many similarities to that of the vapour. A. J. M.

Infra-red absorption spectrum and configuration of cyclohexane. R. S. Rasmussen (*J. Chem. Physics*, 1943, 11, 249–252).—32 infra-red absorption frequencies are recorded between 673.4 and 4330 cm^{-1} for cyclohexane vapour at 5 and 40 mm. Hg and room temp. Five bands are found in the C–C stretching and CH_2 rocking and twisting range, in agreement with the chair structure (symmetry D_{3d}) rather than the cradle or planar structure. The band envelopes agree with Gerhard and Dennison's theory (A., 1933, 337). L. J. J.

Quantitative photographic absorption determinations on the CH bands of aliphatic alcohols at λ 9100 Å. R. Ziegler (*Z. Physik*, 1940, 116, 716–728).—The absorption spectra (λ 8500–13,000 Å.) of MeOH, EtOH, PrⁿOH, PrⁱOH, BuⁿOH, BuⁱOH, Bu^tOH, iso- and tert.- $\text{C}_5\text{H}_{11}\text{OH}$, n - $\text{C}_6\text{H}_{13}\text{OH}$, $(\text{CH}_2\text{OH})_2$, and glycerol were determined with the pure alcohols and with solutions. The integral absorption of the bands of the third CH overtone at 9100 Å., and the positions of the neighbouring OH bands, were determined. With most of the alcohols there is a widening and splitting of the CH bands, due to association, which is dependent on the dilution in the case of solutions of the alcohols in non-polar solvents. In consequence of the effect of association, the integral absorption of the bands of the individual alcohols is not \propto no. of CH vibrations in the mol. Diffuse OH bands indicate the existence of association, although sharp OH bands due to single mols. are also found. The fine structure of these sharp OH bands is compared with previous data; it can be explained as a rotational splitting. If this occurs, however, free rotation in solution is not possible with MeOH and PrⁿOH, as the OH bands of these substances show no splitting. A. J. M.

Absorption of light by α -dien- γ -inenes in the region 2300–2900 Å. H. Bastron, R. E. Davis, and L. W. Butz (*J. Amer. Chem. Soc.*, 1943, 65, 973–975).—Absorption spectra (2300–2900 Å.) are recorded for the following in EtOH, figures quoted being for the max.: $(\text{CH}_3)_2\text{CMe}\cdot\text{C}_2\text{H}_5$ (b.p. 82–85°/101 mm.) 2525 Å. (ϵ 14,500); α - Δ^1 -cyclopentenyl- (b.p. 81°/13 mm.) 2615 Å. (ϵ 13,000) and (mainly 2-methyl- Δ^1 -cyclopentenyl- Δ^2 -buten- Δ^3 -inene (b.p. 90°/14 mm.) 2600 Å. (ϵ 11,500); α - Δ^1 -cyclopentenyl- β - Δ^1 -cyclohexenyl- (b.p. 110–113°/1 mm.) 2650 (ϵ 15,000) and 2780 Å. (ϵ 11,500) [min. at 2750 Å. (ϵ 10,500)] and - β -4-methoxy- Δ^1 -cyclohexenyl-acetylene (b.p. 136°/1.5 mm.) 2645 (ϵ 14,750) and 2770 Å. (ϵ 11,500) [min. at 2720 Å. (ϵ 11,000)]; $\alpha\beta$ -di- Δ^1 -cyclohexenyl- (b.p. 130°/2 mm.) 2625 (ϵ 12,500) and 2755 Å. (ϵ 9000) [min. at 2725 Å. (ϵ 8000)], and α - Δ^1 -cyclohexenyl- β -(mainly 2-methyl- Δ^1 -cyclohexenyl-acetylene (b.p. 118–121°/0.5 mm.) 2650 Å. (ϵ 12,000). Introduction of one or more rings progressively moves the principal absorption max. to longer λ . Comparison with $(\text{CH}_3)_2\text{CMe}\cdot\text{CH}_2$ [max. at 2611 Å. (ϵ 45,600)] and $\alpha\beta$ -di- Δ^1 -cyclohexenylethylene [max. at 2690 Å. (ϵ 22,900)] shows that replacement of C:C by C \equiv C shifts the principal max. to longer λ and considerably decreases ϵ . R. S. C.

Quantitative determination of the absorption of benzene and benzene derivatives in the near infra-red. H. Kempter (*Z. Physik*, 1940, 116, 1–18).—A photo-electric method for the rapid determination of absorption in the near infra-red (7000–11,000 Å.) to within 0.1% is described. Determinations were made by the null method, and for the Cs cell used the compensation voltage was \propto intensity of illumination. Beer's law holds accurately for solutions of C_6H_6 in CCl_4 , and Lambert's law was tested in the case of C_6H_6 , PhMe, xylene, and $\text{C}_6\text{H}_5\text{Me}_2$. The absorption of C_6H_6 , PhMe, p -xylene, s - $\text{C}_6\text{H}_5\text{Me}_2$, PhEt, PhNO₂, BzOH, polystyrene, styrene, and PhCl was determined. The proportionality between absorption in the

CH band and the no. of CH valencies of the same degree of saturation is verified. A. J. M.

Spectrophotometric study of green colour in peas and okra.—See B., 1943, III, 185.

Aromatic hydrocarbons and their derivatives. XXXII. Influence of angular anellation on the absorption spectra of aromatic hydrocarbons. E. Clar (*Ber.*, 1940, 73, [B], 596–606; cf. A., 1940, II, 273).—Absorption spectra data are recorded for 1:2:3:4-, 1:2:5:6-, and 1:2:7:8-di- and 1:2:3:4:5:6-tri-benz-anthracene, 1:2:9:10-dibenzotetracene, pentaphene, isopentaphene, 1:2-benzpentaphene, phenanthrene, chrysene, 3:4- and 8:9-benzotetraphene, anthraceno-2':1':1:2-anthracene, anth-anthracene, etc., and the relationship of the spectra to mol. structure is discussed. A. T. P.

Orientation of molecules produced photochemically in rigid solvents. G. N. Lewis and J. Bigeleisen (*J. Amer. Chem. Soc.*, 1943, 65, 520–526).—Long conjugated mols., e.g., benzidines, after illumination in solid media with plane-polarised light show max. absorption for light polarised parallel and min. absorption for polarisation perpendicular to the exciting radiation (normal orientation). In abnormal orientation, as with Wurster's blue (I), the absorption relationship is inverted. Max. polarisability axes of the mol. and photochemically produced ion are parallel and perpendicular, respectively, in normal and abnormal orientations. Max. orientation is calc. and compared with observed vals. Oriented solutions of (I) lost orientation when warmed, and at higher temp. the colour also faded. W. R. A.

Ultra-violet dispersion frequencies of the alkali-metal oxides. W. Rauch (*Z. Physik*, 1940, 116, 652–656).—The prep. of thin films of alkali-metal oxides on quartz is described. The ultra-violet dispersion frequencies have been obtained. The position of the first max. of the bands is satisfactorily given by an empirical formula. A. J. M.

Measurement of relaxation time of fluorescence. W. Kirchhoff (*Z. Physik*, 1940, 116, 115–121).—An improved fluorometer for measuring relaxation times is described. The vals. obtained for fluorescein (4.90×10^{-9} sec.) and eosin (4.82×10^{-9} sec.) agree well with vals. formerly obtained. With ψ -isocyanine and two of its derivatives and quinoline-red the relaxation time found was $< 10^{-9}$ sec. This is the smallest val. yet obtained, and can be explained if it is supposed, with Scheibe, that the fluorescence is due not to a single mol. but to a polymeric complex, which is regarded as a system of coupled resonators; this assumption is not necessary, however, and it is possible to explain the small relaxation time if the mol. is regarded as a normal oscillator. A. J. M.

Mechanical and optical "excitation" of colour centres. A. Smekal (*Z. Physik*, 1940, 116, 525–546).—The colour band of NaCl crystals is not, in general, a single F -band, but consists of an F - and an F' -band very close together, which cannot be separated optically. Their presence is indicated by the magnitude of the half-val. widening and its dependence on the state of the crystal. The mutual thermal and optical transformation of F - and F' -centres depends on the state of the crystal. In optical excitation phenomena, F -, F' -, and F_2 -centres all take part. The state of the crystal is also responsible, at least partly, for the general space arrangement of colour centres. A. J. M.

Behaviour of phosphors when irradiated intermittently with electrons. M. Knoll (*Z. Physik*, 1940, 116, 385–414).—The behaviour of phosphors when irradiated intermittently with electrons is investigated, with special reference to the screens of cathode-ray tubes. The period elapsing before the phosphor responds, and the time for which it remains glowing after the removal of the excitation, are examined at low temp. These periods depend, in the case of ZnS–CdS phosphors, on the electron concn. and not on the temp. (0° to –190°) of the screen. The decrease of brightness on warming to 0° is investigated for ZnO and ZnS–CdS on glass and metal carriers. With intermittent excitation there is a decrease in brightness with increase of electron concn. Cooling of the phosphorescent screen shows this to be a temp. effect; it is greater with glass than with metal screens. Charging and secondary emission phenomena are also considered. A. J. M.

Determination of chlorine vibrations in dichlorobenzenes from intensities and polarisations of their Raman lines. G. Nordheim and H. Sponer (*J. Chem. Physics*, 1943, 11, 253–262).—Theoretical. Raman tensors for Cl vibrations in $\text{C}_6\text{H}_4\text{Cl}_2$ are calc. by adding or subtracting single C–Cl contributions for a series of axes fixed with respect to the mol., and intensity ratios are deduced for symmetrical valency and unsymmetrical deformation vibrations. Very small depolarisation factors are found for the former and complete depolarisation for the latter, for all permitted Raman lines. L. J. J.

Thermodynamics and molecular structure of benzene and its methyl derivatives. III. Vibration frequencies of benzene. IV. Vibration frequencies of toluene, o -, m -, and p -xylenes, and mesitylene. K. S. Pitzer and D. W. Scott (*J. Amer. Chem. Soc.*, 1943, 65, 814–817,

817—824; cf. A., 1943, I, 223).—III. Wilson's numbering scheme (cf. A., 1934, 829) being followed, $\nu\nu$ vals. for the normal modes 3, 14, 15, and 17 have been assigned on the C_p data, as follows: 3, 1298; 15, 1170; 14, 1693; 17, 985 cm^{-1} .

IV. With the aid of a product ratio analogous to the Teller-Redlich product rule for isotopic substitution, assignments of vibrational $\nu\nu$ have been made from calorimetric and spectroscopic data for mesitylene, PhMe, and *o*-, *m*-, and *p*-xylene. W. R. A.

Ionisation potential of the nitrogen molecule. U. Stille (*Z. Physik*, 1940, 116, 144—152).—The occurrence of negative bands in the spectrum of the after-glow of N_2 is discussed. The possibility of the ionisation of N_2 by a collision process in active N is discussed in relation to the val. of 13.3 v. obtained for the ionisation potential of N_2 by Rypdal and Vegard (*Geofys. Publ. Oslo*, 1940, 12, No. 12) with an electron-collision apparatus, in which the intensity of the emitted light was measured as a function of the velocity of the exciting electrons. This result for the ionisation potential is compared with vals. formerly obtained, which are all >13.3 v. Acceptance of the new val. brings disagreement with a no. of well-established data. A. J. M.

Dependence of column ionisation by α -rays on pressure. E. Helbig (*Z. Physik*, 1940, 116, 444—453).—The effect of pressure (p) on column ionisation produced by a beam of α -rays perpendicular to the electric field has been investigated in air, CO_2 , H_2 , A, and air- CO_2 mixtures. The theory of column ionisation is presented. The p effect given by the theory is verified in the case of irradiation perpendicular to the electric field. Large deviations occur only for H_2 and A for small fields, and these are due to ion loss in consequence of diffusion to the walls. The recombination coeffs. for air and CO_2 are calc. For both gases it decreases with increasing p . A. J. M.

Secondary production of electrons through the photo-effect in a non-self-dependent discharge in air. H. Costa (*Z. Physik*, 1940, 116, 508—514).—The proportion of secondary electrons produced in a Townsend discharge in air up to near the breakdown point has been determined by a method similar to that used for H_2 (A., 1940, I, 2). Vals. vary from 50% to 20% according to pressure, the lower val. being obtained at higher pressure. In addition to the photo-effect another process was detected depending on the nature of the cathode surface, which may be due to the collision of positive ions on the cathode. A. J. M.

Composite photo-cathodes. II. P. Görlich (*Z. Physik*, 1940, 116, 704—715).—The emission work of $[Ag]-Cs_2O, Cs, Ag-Cs$ cathodes has been determined thermally and photo-electrically. In the temp. range 350—460° K. the Richardson curve is followed, but there are deviations at temp. $<350^\circ$. The emission mechanism of the above, and of $[Ag]-Cs_2O, Cs-Cs$ cathodes, is discussed. Experiments with cathodes of the type $[Ag]-Cs_2O, X, Cs-Cs$ (where $X = Mo, Al, Pb, Ni, Mn$) show that the long- λ max. increases the smaller is the at. vol. of X, but the rule does not hold if X is an alkali or alkaline-earth metal, or Ag. The extent to which the long- λ max. is altered by X depends on the quantity of X present. The sensitivity was increased by the addition of the foreign metal in every case except Mo. Addition of foreign metals to the Ag in the cathode $[Ag]-Cs_2O, Ag, Cs-Cs$ nearly always decreased the sensitivity. Comparison of cathodes of the type $[Y]-Cs_2O, Cs-Cs$ and $[Y]-Cs_2O, Y, Cs-Cs$ ($Y = Be, Mn, Pb, Cu$) indicates that the introduction of the foreign metal (Y) causes a displacement of the long- λ max. towards the red, and there is an increase in efficiency owing to diffusion of the added metal. For cathodes of the type $[Z]-Cs_2O, Ag, Cs-Cs$ ($Z = Al, Mn, Pb$), there was a small displacement of the long- λ max. towards the red, and an increase in sensitivity. The foreign metal not only affects the conductivity and position of the long- λ max. but there is also an interaction between the ionisable Cs atoms and the foreign metal atoms, affecting the photo-ionisation of the Cs atoms, and thus the sensitivity. Ag occupies a special place as such a metal. A bibliography of literature on alloy cathodes is given. A. J. M.

Theory of boundary surface rectifiers. W. Schottky (*Z. Physik*, 1942, 118, 539—592).—A mathematical theory, with special reference to Se and Cu_2O rectifiers, has been developed. W. R. A.

Anomalous dispersion and loss angle in amorphous organic solids at high frequencies. W. Holzmüller (*Z. Elektrochem.*, 1941, 47, 129).—Theoretical discussion (cf. A., 1942, I, 8). C. R. H.

Apparent ionic volume in infinitely dilute solutions.—See A., 1943, I, 198.

Anomalous reflexion at optical line gratings. K. Artmann (*Z. Physik*, 1942, 119, 529—567).—The bright bands produced by high-order reflexion of polarised light at metallic gratings, due to anomalous intensification of approx. tangentially reflected rays, are due to synchronisation of an infinite no. of multiply deviated waves. Quant. expressions are derived for the intensity distribution. L. J. J.

Magnetic rotation in doubly-refracting media. F. Gabler (*Z. Physik*, 1940, 116, 271—280).—The equations governing the be-

haviour of doubly-refracting media in a magnetic field are discussed. If the magnetic rotation is small it disappears rapidly as soon as marked double refraction begins. If the magnetic rotation is large, it increases at first with the double refraction, and then shows a periodic variation of decreasing amplitude, representing gradual approach to a limiting val. Apparatus for testing these conclusions is described. The double refraction is produced in a Kerr cell filled with $PhNO_2$. From determinations of the degree of polarisation of light passing through the cell in a magnetic field, very good agreement between theory and experiment is obtained. A. J. M.

Paramagnetism of molecules depending on electron spin. T. Neugebauer (*Z. Physik*, 1940, 116, 428—435).—Mathematical. The paramagnetic susceptibility and the Cotton-Mouton const. are obtained in the case for which the spin moment may be considered as not completely free. From experimental vals. for quantities involved, it follows that for O_2 the mean square of the magnetic moment in the direction of the axis of rotation is $\sim 1.3\%$ $>$ that in a perpendicular direction. This agrees with deductions from the band spectrum. The paramagnetism of S_2 and SO is governed by similar considerations. A. J. M.

Magnetic double refraction in alkali metal vapours. F. Gabler (*Z. Physik*, 1940, 116, 495—507).—An apparatus for the investigation of the Voigt effect using a Babinet compensator is described. The dependence of the effect on the ρ of the vapour, and the observation of double refraction in the region of the forbidden Zeeman transitions, are demonstrated. The wave-mechanical theory of the Voigt effect gives results in qual. agreement with experiment. A. J. M.

Theory of acoustic double refraction in colloidal solutions. S. Oka (*Z. Physik*, 1940, 116, 632—651).—The directive effect of an ultrasonic field on suspensions of disc-shaped particles has been considered, interaction being neglected. The theory of acoustic double refraction of suspensions of such particles has been developed for the stationary case, and for the state existing after the cutting off of the field. The decay of the double refraction with time when the field is removed is exponential. The relaxation time is calc. for particles of various dimensions and liquids of different η . A. J. M.

Application of group theory to isomerism in general. T. L. Hill (*J. Chem. Physics*, 1943, 11, 294—297).—Polya's theorem (A., 1936, 322, 1358) can be applied to determine not only the no. of structural isomerides of org. compounds, but also the no. of optical and geometrical isomerides of C compounds and co-ordination compounds corresponding with any co-ordination no. L. J. J.

Structure of the boron hydrides. H. C. Longuet-Higgins and R. P. Bell (*J.C.S.*, 1943, 250—255).—It is suggested that the B hydrides contain the H bridge linkage $>B\begin{smallmatrix} H \\ \diagup \quad \diagdown \\ H \end{smallmatrix}<B<$, which can be formulated as a resonance hybrid between structures containing only normal electron-pair bonds. It is shown that this type of linkage is as probable as the accepted structure containing one-electron bonds, and that B and Ga are the only elements known to form covalent hydrides likely to contain such a linkage. The borohydrides of Be and Al are accounted for on the same hypothesis. Experimental data for the electron diffraction, Raman and infra-red spectra, and sp. heat of B_2H_6 are analysed and shown to support a bridge configuration rather than one resembling C_2H_6 . Structures are suggested for the higher B hydrides. N. M. B.

Ionic radii and the periodic system. E. Kordes (*Z. Elektrochem.*, 1941, 47, 152—155).—The Pauling and Goldschmidt formulæ for calculating ionic radii are discussed and successfully applied, after making certain assumptions, to electrons in lower valency states. C. R. H.

Proton affinity of O' and O'' and electron affinity of O and O' . G. Briegleb (*Naturwiss.*, 1942, 30, 532—533).—Lattice energies and heats of dissolution in H_2O of alkaline-earth halides give for proton (P) and electron (E) affinities the vals. $P_{O'} = 608$, $P_{O''} = 356$, $E_O \rightarrow O' = -150$, $E_O \rightarrow O'' = 56$, $E_{O'} \rightarrow O'' = -206$, and $E_{OH} \rightarrow OH = 45$ kg.-cal. (all vals. ± 10 —20 kg.-cal.). L. J. J.

Optical method of measuring the angle of contact. S. J. Khambata and A. B. Sahiar (*J. Univ. Bombay*, 1943, 11, A, Part 5, 52—55).—The contact between turpentine and glass in air has a fine fringe extending beyond that previously observed. The angle can be calc. by photographing interference fringes in the liquid and is 0.4° at 28.6° , instead of 17° as previously recorded. The angle for H_2O and clean glass is 0° . F. R. G.

Dependence of size of liquid drops on their rate of formation. H. Neumann and R. Seeliger (*Z. Physik*, 1939, 114, 571—578).—Data are recorded for the variation of drop size with rate of formation for a no. of liquids of different surface tension and viscosity. L. J. J.

III.—CRYSTAL STRUCTURE.

Weissenberg controlled-temperature technique.—See A., 1943, I, 209.

Crystal chemistry. I. Isotypism and isomorphism. H. Strunz (*Naturwiss.*, 1942, 30, 526—531).—The term "isomorphism" is restricted to substances with analogous constitution, close similarity of cryst. structure, and the power of forming homogeneous mixed crystals. In the absence of the latter property the term "isotypism" is preferred. "Diadochism" is interchangeability of individual ions without change of cryst. form. L. J. J.

Isomorphous replaceability of chalcogens in organic compounds.—See A., 1943, II, 263.

Molecular structure of liquids in experiments with models. H. A. Stuart (*Z. Elektrochem.*, 1941, 47, 110—112).—Technical details in the prep. of a film illustrating liquid structure are discussed. C. R. H.

Molecular structure of supercooled and of glassy ethyl alcohol. W. Kast and A. Prietzsck (*Z. Elektrochem.*, 1941, 47, 112—116).—At -150° EtOH shows pronounced chain structure; the chains become linked together on addition of H_2O , the resulting increase in η inhibiting crystallisation and leading to the formation of the glassy state. C. R. H.

Lattice constants of calcite determined by the rotating-crystal method. A. Ievins and M. Straumanis (*Z. Physik*, 1940, 116, 194—206).—The lattice consts. of calcite specimens of varying degrees of purity have been determined at different temp. by the rotating-crystal method, the asymmetric process being used. The purest crystals had d_{100} 3.02900 Å. at 18° . Eight samples showed a variation in this val. of 0.00123 Å. The val. is usually the lower the more impure is the crystal. The presence of $MnCO_3$ and $MgCO_3$ lowers it, but $SrCO_3$ raises it. The rhombohedral angle $\alpha = 101^\circ 54' 5''$. A. J. M.

Isotypism with occupation of vacant lattice spaces. $Fe^{+++}_2[PO_4]_2 \cdot 4H_2O$ and $Fe^{++}_2[PO_4]_2 \cdot 4H_2O$. H. Strunz (*Naturwiss.*, 1942, 30, 531).—Phosphosiderite, $Fe^{+++}_2[PO_4]_2 \cdot 4H_2O$ (I), and phosphophyllite, $(Fe^{++}, Zn)_3[PO_4]_2 \cdot 4H_2O$ (II), have the following isotypic monoclinic lattice dimensions: (I) a_0 5.28, b_0 9.75, c_0 8.71 Å., β $90^\circ 36'$, space-group $C_{2h}^2-P_{21}/m$; cell content $4Fe^{+++}$, $4PO_4$, $8H_2O$; (II) a_0 2×5.30 , b_0 $\frac{1}{2} \times 10.18$, c_0 2×8.88 Å., β $90^\circ 28'$, space-group C_{2h} ; half-cell content $6(Fe^{++}, Zn)$, $4PO_4$, $8H_2O$. PO_4 and H_2O have the same basic lattice in both minerals, with octahedral co-ordination centres occupied by $4Fe^{+++}$ and free lattice spaces in (I), and by $6(Fe^{++}, Zn)$ in (II). L. J. J.

Crystal structure of 4 : 4'-dinitrodiphenyl [$C_{12}H_8(NO_2)_2$]. J. N. van Niekerk (*Proc. Roy. Soc.*, 1943, A, 181, 314—329).—It is shown that the crystal is monoclinic but can be referred to an orthogonal unit cell with a 3.77, b 9.56, c 15.39 Å., which contains two mols.; space-group Pc . The method of Fourier analysis has been applied and projections of electron density on two of the axial planes are given. The packing of the mols. in the structure is discussed. G. D. P.

X-Ray study of hydrocarbon from phthiocerol. E. Stenhagen (*J. Biol. Chem.*, 1943, 148, 695—697).—X-Ray examination of the parent hydrocarbon of phthiocerol suggests that it is a normal straight-chain hydrocarbon, probably n -tetratriacontane. P. G. M.

Diffraction experiments with very fine electron beams. H. Boersch (*Z. Physik*, 1940, 116, 469—479).—The crystal structures of thin foils of Au and films of NH_4Cl and $NaCl$ were determined by using a very fine beam of electrons (diameter 0.005 mm.). The diffraction of the primary beam in Au foil shows a four-fold axis of symmetry, indicating that the foil is composed of polycryst. material. The crystallites are the more regularly oriented the nearer they are together. The passage of electrons through thin films of insulating material can give rise to charges, which can, under suitable conditions, lead to an image of the object. The lens effect of the charges decreases as the diameter of the primary beam increases. A. J. M.

Occurrence of black lines in the electron-microscopic images of crystalline lamellae. M. von Ardenne (*Z. Physik*, 1940, 116, 736—738).—The black lines observed are not due to any difference of ρ in the object, and no satisfactory explanation of their existence can be advanced. A. J. M.

Morphology of finely-powdered lead oxide sublimate. R. Meldau and M. Teichmüller (*Z. Elektrochem.*, 1941, 47, 191—196).—The results of an electron-microscopical examination of both modifications of PbO are discussed and illustrated with micrographs. C. R. H.

Electron interferometric measurement of free molecules. Isomerism of the nitrogen atom. F. Rogowski (*Z. Elektrochem.*, 1941, 47, 152).—Interferometric data for $MeNO_2$ show that the C—N and N—O distances are 1.47 and 1.22 Å., respectively, with the O—N—O angle 130 — 140° . For $MeO \cdot NO^*$ the C—O, O—N, and N—O* distances are 1.44, 1.37, and 1.22 Å., respectively (all distances ± 0.02 Å.). C. R. H.

Influence of supersonic vibrations on the magnetic properties of nickel. G. Schmid and U. Jetter (*Z. Elektrochem.*, 1941, 47, 155—162).—The influence of supersonic vibrations (frequency 10—20 kHz.) on the magnetic properties of hard-drawn Ni tubing has

been investigated. The changes in properties are mostly irreversible. The increase in magnetic properties brought about by the vibrations increases with the amplitude of the latter. The max. magnetisation attained, viz., ~ 8 times the initial magnetisation, is only $\sim 40\%$ of the ideal magnetisation val. The effect of the vibrations is to narrow the hysteresis loops. The vibrations apparently increase magnetisation by loosening the crystal structure. C. R. H.

Theory of anomalous reflexion of atomic rays at crystal surface layers. I. K. Artmann (*Z. Physik*, 1942, 118, 624—658).—An optical theory of the anomalous reflexion of at. rays at crystal surface layers has been developed, a layer on the surface being assumed in which matter waves may be totally reflected. The thickness of the surface layer depends on the magnitude of the van der Waals forces. W. R. A.

Mechanical properties of polymeric materials.—See B., 1943, II, 257.

Elasticity of rubber.—See B., 1943, II, 264.

Characteristic movements in crystal lattices. U. Dehlinger and A. Kochendörfer (*Z. Physik*, 1940, 116, 576—585).—A formula is deduced for the no. of at. transitions in unit time for thermal excitation of crystals, and the vals. of the consts. involved are estimated. The mathematical demonstration of an aperiodic motion of a series of atoms in the lattice put forward by Frenkel and Kontorova (A., 1941, I, 159) is only a special case of a migration of displacements and chain reactions through the lattice, proposed previously. Such movements as plastic deformation and twinning must have their origin in transitions in single atoms excited thermally. Long- λ vibrations recently discovered by Förster *et al.* (*Z. Metallk.*, 1940, 32, 165) are intermediate between aperiodic vibrations and the normal small- λ vibrations. A. J. M.

Micrographic observations of slip lines in α -brass. R. G. Treuting and R. M. Brick (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1356, 6 pp.; *Met. Tech.*, 8, No. 5).—The formation of slip lines on a plane surface polished along the length of a cylindrical single-crystal tensile specimen of α -brass was studied. The crystal was strained 0.074 in. and then annealed at 850° for 15 hr., when it recryst. to form two grains. Slip planes did not become visible until after flow had begun. J. C. C.

Polymorphism of phosphoric oxide. W. L. Hill, G. T. Faust, and S. B. Hendricks (*J. Amer. Chem. Soc.*, 1943, 65, 794—802).—The m.p. and monotropic relation of the three forms of P_2O_5 have been determined. The phase diagram (70 — 600°) for P_2O_5 includes three liquid-vapour-solid triple points, corresponding with the hexagonal, orthorhombic, and stable forms. Two liquids have been established, differing in degree of polymerisation, and obtained by melting the hexagonal and stable forms, respectively. n , ρ , and thermal, hygroscopic, and structural properties of the various phases have been determined. Superheating in solid-solid transitions is discussed. W. R. A.

Polymorphism of arsenious oxide. J. H. Schulman and W. C. Schumb (*J. Amer. Chem. Soc.*, 1943, 65, 878—883).—Solubilities in m -HCl at 2 — 35° and v.p. at 171 — 297° of monoclinic and octahedral As_2O_3 have been determined. Monoclinic As_2O_3 is thermodynamically stable from 2° to the m.p. Solubility data establish the enantiotropic relation between the two forms, with transition temp. -13° . The latent heat of transition has been calc. from solubilities in m -HCl and heats of dissolution in $4M$ -NaOH. H_2O vapour catalyses the octahedral \rightarrow monoclinic transformation at 180° . Existence of three other supposed forms of As_2O_3 is rendered uncertain by X-ray examination of products prepared as previously described. W. R. A.

IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

Mol. wt. of polyisobutylenes.—See A., 1943, I, 199.

Electrical conductivity of liquid dielectrics and its variation by ultrasonic waves. F. Seidl (*Z. Physik*, 1940, 116, 359—365).—The conductivity of C_6H_{14} , PhMe, and CCl_4 is increased when they are exposed to ultrasonic waves. Small field strengths were used. The results can be explained by supposing that the complex groups of mols. are broken down by the ultrasonic waves, and that there is a simultaneous recombination of ions. When the ultrasonic waves are cut off, the current decreases, usually to its original val. A. J. M.

Superconduction and magnetic exchange interaction. H. Welker (*Z. Physik*, 1939, 114, 525—551).—The theory of superconduction presented is based on London's theory and postulates an "electron-liquid" structure for the conduction electrons, which are constrained by coulombic repulsion to preserve a definite mean separation. A magnetic exchange force is postulated to account for an electronic "velocity superstructure." L. J. J.

Absolute diamagnetism of superconductors. T. Neugebauer (*Z. Physik*, 1942, 119, 581—589).—Theoretical. The assumption $\chi = -(4\pi)^{-1}$ leads to more intense magnetic fields in the interior of super-

conductors than in ambient space, whereas London's theory leads to vanishing field intensity within a superconductor. L. J. J.

Electric moments of substituted benzoic acids. II. Moments of *o*-, *m*-, and *p*-fluoro- and of *o*-chloro- and *o*-bromo-benzoic acids. M. E. Hobbs and A. J. Weith, jun. (*J. Amer. Chem. Soc.*, 1943, **65**, 967—971).—Vals. of μ of *o*-, *m*-, and *p*-fluoro- (I), *o*-chloro- and -bromo-benzoic acids in dioxan are 2.10, 2.16, 1.99, 2.43, and 2.50 D. The angle between the resolved CO_2H group moment and the Ph-C axis, calc. from μ of (I), is 74° , in good agreement with previous vals. from data on *p*-chloro- and -bromo-benzoic acids. Factors operative in the vector addition of moments are discussed.

W. R. A.

Ferritin. III. Magnetic properties of ferritin and some other colloidal ferric compounds. L. Michaelis, C. D. Coryell, and S. Granick (*J. Biol. Chem.*, 1943, **148**, 463—480).—Measurements were performed by a modified Gouy procedure using both the macro- (A., 1937, I, 293) and the micro-method (A., 1942, I, 14). The Fe atoms of colloidal $\text{Fe}(\text{OH})_3$ in any one prep. were in different magnetic states. The two extremes of all the cases occurring were represented either by those with almost all Fe atoms in the 5 odd-electron state or by those having most of the Fe atoms in the 1 odd-electron state, depending on the way in which the compound had been prepared. The Fe of ferritin (I) is always in the 3-electron state, as is also the Fe in the amorphous $\text{Fe}(\text{OH})_3$ prepared from (I) by pptn. with alkali. The susceptibility corresponded with that for the 3 odd-electron state with spin contributions alone. It is suggested that " $\text{Fe}(\text{OH})_3$ " does not exist as individual mols. of $\text{Fe}(\text{OH})_3$ or $\text{Fe}(\text{OH})_3(\text{H}_2\text{O})_3$, but that partial dehydration takes place, establishing O bridges from one Fe atom to another, and thus producing neighbouring octahedral complexes with shared corners and edges. The O of such a bridge may be bound either by covalent or by ionic bonds, according to the valency angles established. The effects of temp. and of Fe-Fe interaction are discussed. Reduction of (I) by $\text{Na}_2\text{S}_2\text{O}_4$ gave a Fe^{II} compound of the same magnetic state as FeSO_4 . No F or CN complex of (I) could be detected by either magnetic or optical methods.

J. E. P.

Reversible processes in magnetic materials with small internal strains. W. Döring (*Z. Physik*, 1939, **114**, 579—601).—Change of elasticity modulus with strain, reversible permeability at the remanence point, and change of remanence with tension are correlated with initial susceptibility and deduced for magnetic materials in which crystal energy is $>$ the effect of internal strain. Internal strains are assumed isotropic.

L. J. J.

Effect of elastic compression on the susceptibility maximum of nickel. Characteristic strains. (A) S. Velayos. (B) H. Bittel (*Z. Physik*, 1940, **116**, 340—348, 349—351).—(A) The effect of longitudinal compression on the magnetic susceptibility (χ) of Ni rods has been examined. The max. val. of χ is increased with increasing compression, and this val. is reached at a smaller field strength with increasing compression. The actual vals. of χ also depend on the internal strains in the metal. The internal strain can be calc. from observations of other magnetic properties, e.g., permeability, magnetisation, and magnetostriction. The vals. obtained agree satisfactorily with those obtained from the effect of compression on χ .

(B) The work of Velayos (see above) indicates that the coercivity is \propto mean val. of the internal strain when no external strain is applied. This holds even if the strains are produced by different thermal or mechanical treatment. It follows that the magnetic field strength for max. χ must be \propto internal strain, and the results of Velayos agree with this.

A. J. M.

Specific heats at low temperatures of manganese carbide and dioxide. K. K. Kelley and G. E. Moore (*J. Amer. Chem. Soc.*, 1943, **65**, 782—785).—Vals. of C_p of Mn_3C and MnO_2 have been measured at 51—298° K. MnO_2 shows an anomaly between 85° and 100° K., with the max. at $92.12 \pm 0.05^\circ$ K. Vals. of $S_{298.16}$ and $\Delta G_{298.16}$ are: Mn_3C 23.6 ± 0.3 , MnO_2 12.7 ± 0.1 g.-cal. per degree per g.-mol.; Mn_3C —22,800, MnO_2 —109,900 g.-cal. per g.-mol.

W. R. A.

Heat capacities of hydrocarbon gases. D. R. Stull and F. D. Mayfield (*Ind. Eng. Chem.*, 1943, **35**, 639—645).—In order to make heat capacity calculations over a wide temp. range the authors have coupled the Bennewitz and Rossner method (cf. A., 1938, I, 303) with the rotational modification suggested by Dobratz (cf. A., 1941, I, 369), retaining the use of Einstein functions. Tables of bonding frequency contributions to mol. heat capacity for temp. 250—1500° K. and of solutions to the Einstein function for one degree of freedom are presented. Calc. heat capacities for 29 hydrocarbons over the same temp. range show an average difference of $\pm 4\%$ from published vals.

C. R. H.

Thermodynamics and molecular structure of benzene and its methyl derivatives. I. Thermodynamic measurements on the pure substances. Heat capacities, heats of fusion and vaporisation, vapour pressures, and entropies of benzene, toluene, and the xylenes. K. S. Pitzer and D. W. Scott (*J. Amer. Chem. Soc.*, 1943, **65**, 803—811).—The m.p. of the xylenes are: *o*-, $247.82 \pm 0.1^\circ$; *m*-, $225.27 \pm 0.15^\circ$; *p*-, $286.39 \pm 0.05^\circ$ K. Vals. of C_p have been determined calorimetrically at 15—350° K. The following expressions for $\log p$ have

been derived from v.p. data: PhMe (0—50°), $-2866.53/\theta - 6.7 \log \theta + 27.6470$; *o*-xylene (0—60°), $-3327.16/\theta - 8.0 \log \theta + 31.7771$; *m*-xylene (0—60°), $-2871.66/\theta - 5.0 \log \theta + 22.9270$; *p*-xylene (13.23—60°), $-3080.31/\theta - 6.7 \log \theta + 27.8581$, (0—13.23°), $-3141.33/\theta + 11.6092$. Heats of fusion and vaporisation are: PhMe —, 9115 ± 50 ; *o*-xylene 3250 ± 10 , $10,470 \pm 50$; *m*-xylene 2784 ± 15 , $10,160 \pm 50$; *p*-xylene 4090 ± 20 , $10,110 \pm 50$ g.-cal. per g.-mol. Entropies for gas at 1 atm. and 298.16° K. are: C_6H_6 64.39 ± 0.3 ; PhMe 76.44 ± 0.3 ; *o*- 84.50 ± 0.3 , *m*- 85.60 ± 0.3 , and *p*-xylene 84.27 ± 0.3 g.-cal. per degree per g.-mol. Gas heat capacities for all these and CCl_4 have been determined.

W. R. A.

Physical data of monoalkylcyclo-pentenes and -pentanes.—See A., 1943, II, 222.

Thermodynamic properties of propane. W. V. Stearns and E. J. George (*Ind. Eng. Chem.*, 1943, **35**, 602—607).—*P*-*H* and *S*-*t* charts, and tables of d (liquid and vapour), l , P , S , and H , are given for C_3H_8 in the in.-lb.-°F. system from -80° to 200° F. and 5.65—575.0 lb. per sq. in. abs.

M. H. M. A.

Equation for the isotherms of pure substances at their critical temperatures. C. H. Meyers (*J. Res. Nat. Bur. Stand.*, 1942, **29**, 157—176).—The empirical equation of state given represents the crit. isotherms of 12 out of 13 substances up to 1.1 times the crit. density with $< \frac{1}{2}\%$ error. The exception is H_2O with $\frac{1}{2}\%$ error. Fugacity vals. along the crit. isotherm can be calc.

L. J. J.

Correlating fluid viscosity. A. S. Smith and G. G. Brown (*Ind. Eng. Chem.*, 1943, **35**, 705—711).—The equation $\eta/\sqrt{M} = f(T_r, P_r)$, where M = mol. wt. and the suffix r refers to the reduced state, which has been derived from the theory of corresponding states, is applied to η - T data for gases and liquids at atm. and higher pressures and under saturated conditions. The equation is applicable to homologous series and to diat. gases. η data for C_2H_6 and C_3H_8 over the pressure range 100—5000 lb. per sq. in. and temp. range 15—200° are recorded.

C. R. H.

Motion of a mercury index in a capillary tube. H. G. Green (*Phil. Mag.*, 1943, [vii], **34**, 393—395; cf. Yarnold, A., 1938, I, 452; *Proc. Physical Soc.*, 1940, **52**, 191, 196).—Mathematical. An alternative analysis, with extended velocity range, shows that results are comparable with those obtained in large-scale continuous flow experiments.

N. M. B.

V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

Autodiffusion of xenon and krypton. W. Groth and P. Harteck (*Z. Elektrochem.*, 1941, **47**, 167—172).—The autodiffusion coeffs. of light and heavy Kr (at. wt. difference 1.74) and Xe (at. wt. difference 2.95) at $20^\circ/760$ mm. are $0.044_3 \pm 0.002_2$ and $0.093 \pm 0.004_5$ sq. cm. per sec., respectively. Between 0 and 760 mm. the difference in abs. pressure between Xe isotope mixtures rich in heavy Xe and those rich in light Xe is < 0.02 mm. In the case of similar Kr mixtures the difference in pressure is $\sim 0.3\%$ of the abs. pressure, the heavier mixture having the lower pressure.

C. R. H.

Fluidity of mixtures which obey Batschinski's law. F. Kottler (*J. Physical Chem.*, 1943, **47**, 277—293).—Derived equations defining the fluidity of ideal and non-ideal mixtures which obey Batschinski's law (A., 1913, ii, 26, 928) have been tested by published data for mixtures of C_6H_6 with PhBr, PhCl, PhI, CCl_4 , and $\text{CH}_2\text{Ph}\cdot\text{OBz}$, and for CS_2 -MeI mixtures. Agreement is good in all cases except the last, where experimental errors are the probable cause of the discrepancies.

C. R. H.

Autodiffusion of liquids. H. Rögener (*Z. Elektrochem.*, 1941, **47**, 164—167).—A method of following the diffusion of two liquids by measuring changes in n is described, and its application to the diffusion of isotopic liquids is illustrated.

C. R. H.

Volatility, diffusion, and vapour pressure in the system acetophenone-Novolak. E. Jenckel and J. Komor (*Z. Elektrochem.*, 1941, **47**, 162—163).—The volatility of COPhMe from the system COPhMe-Novolak \propto the v.p. if the proportion of synthetic resin is $> 30\%$. At higher resin concns. the reduced diffusion coeff. of COPhMe in the system leads to the volatility being $<$ expected.

C. R. H.

Behaviour of mercuric chloride and determination of its parachor. W. V. Bhagwat and P. M. Tosniwal (*J. Indian Chem. Soc.*, 1942, **19**, 492—494).—Vals. for the parachor of HgCl_2 in various solvents range from 150 to 250. The apparent mol. wt. (ebullioscopic) in H_2O is 220—260, and in various org. solvents 290—360. Its coagulating effect on As_2S_3 and Sb_2S_3 sols is between those of Al and Ba salts.

F. J. G.

Intermetallic phases with partial heteropolar linkings. U. Dehlinger (*Z. Elektrochem.*, 1940, **46**, 627—634).—Rules for the formation of heteropolar intermetallic compounds have been formulated and are applied to Hume-Rothery alloys (bronzes) and combinations of alkalis, alkaline earths, rare earths, Al, Ga, In, Cu, Ag, Au, and the transition elements with other metals.

C. R. H.

Preferred orientation in rolled magnesium and magnesium alloys. P. W. Bakarian (*Amer. Inst. Min. Met. Eng.*, 1941, *Tech. Publ.* 1355, 6 pp.; *Met. Tech.*, 8, No. 5).—Pole figures of pure Mg and of Mg alloys with 0.15 and 0.20% of Ca respectively were determined, using small cylindrical specimens 0.038 in. in diameter cut with the axis at various angles to the rolling direction of hot-rolled sheet. The additions of Ca greatly altered the texture of pure Mg. J. C. C.

Ternary cadmium alloys.—See B., 1943, I, 340.

Magnetic study of the two-phase iron-nickel alloys. II. K. Hoselitz and W. Sucksmith (*Proc. Roy. Soc.*, 1943, **A**, 181, 303—313; cf. A., 1940, I, 318).—The method of using measurements of magnetic saturation intensity for the determination of the equilibrium phase boundaries has been extended. The phase diagram of the system Fe-Ni has been determined in the temp. range 525—365°. The mechanism of phase segregation from the single-phase α -state has been studied; one of the phases crystallises out in its equilibrium concn. whilst the residue of the alloy progressively approaches equilibrium composition. G. D. P.

Superheated steam as a solvent. O. Fuchs (*Z. Elektrochem.*, 1941, **47**, 101—110).—When NaCl, KCl, and NaOH volatilise with superheated steam the concn. of salt in the vapour increases rapidly with pressure. The effect of the volatilised salt on the electrical conductivity and dielectric const. of the vapour is negligible. C. R. H.

Solubility of solids in "gases" or "vapours." G. W. Morey and E. Ingerson (*Amer. Min.*, 1942, **27**, 227—228).—The transport of solid material in significant amount by a gas or vapour at high temp. and pressure depends on the solubility of the solid in the vapour, i.e., in unit vol. of vapour the solid content is $>$ corresponds with its own v.p. at the given temp. and pressure. Transport and deposition of corundum, rutile, sillimanite, quartz, and amorphous SiO_2 by H_2O at temp. from 500° to 1000° and at pressures from 3000 to 15,000 lb. has been obtained experimentally. Suitable definitions of "gas" and "vapour" are proposed. L. S. T.

Solubility of hydrogen chloride in cyclohexane. F. Wiegner (*Z. Elektrochem.*, 1941, **47**, 163—164).—Solubility data, expressed as v.p. of HCl, over the range 13—40° are recorded. C. R. H.

Solubility of ammonium chloroplatinate in ammonium chloride solutions. P. S. Belonogov (*Zavod. Lab.*, 1939, **8**, 217).—100 ml. of a solution containing $x\%$ of NH_4Cl dissolve y g. of $(\text{NH}_4)_2\text{PtCl}_6$ at 25°; for $x = 0, 1.86, 9.81, 19.74, 28.36$ $y = 0.5530, 0.0432, 0.0276, 0.0245, 0.0082$, respectively. Addition of HCl lowers y . J. J. B.

Solubility of metals in mercury.—See B., 1943, I, 341.

Hysteresis in sorption. X. Open pore volume in relation to particle radius. K. S. Rao and V. R. Thiruvengatachar (*Proc. Indian Acad. Sci.*, 1943, **17**, **A**, 46—49).—Mathematical. In an assemblage of packed spheres of equal size and of const. total mass the total open pore vol. (v_1) and total cavity vol. (v_2) decrease as particle radius increases, whereas v_1/v_2 increases. W. R. A.

Sorption of ammonia on montmorillonitic clay. I. Cornet (*J. Chem. Physics*, 1943, **11**, 217—226).—Parabolic or hyperbolic sorption isotherms are given by dry NH_3 on NH_4 , K, and finely ground H bentonites. Unground H bentonite shows a short initial parabolic section followed by an inflexion and subsequent second parabolic section, with widening of the c -axis spacing. The sorption occurs at exterior and interplanar surfaces and at lattice discontinuities. Thermal decomp. data for NH_4 bentonite show sorption at base-exchange reactive spots. Lattice OH and polarisation of H_2O mols. may give rise to base-exchange capacity on grinding. L. J. J.

Absence of coprecipitation of barium ion with the chlorides of the silver group and the sulphides of the copper and tin groups in presence of ammonium ion. L. Lehrman and I. Mandel (*J. Physical Chem.*, 1943, **47**, 264—266).—No copptn. (adsorption, occlusion, or post-pptn.) of Ba^{++} occurs when sulphides of the Cu and Sn groups are pptd. in presence of NH_4^+ or when chlorides of the Ag group are pptd. C. R. H.

Surface available to nitrogen on bone black and other carbonaceous adsorbents. V. R. Deitz and L. F. Gleysteen (*J. Res. Nat. Bur. Stand.*, 1942, **29**, 191—225).—Adsorption isotherms for N_2 on a no. of samples of adsorbent charcoal at liquid N_2 and liquid O_2 temp. are recorded. For coconut shell charcoal the results accord with unimol. adsorption and for the other samples the results at $>50\%$ of the v.p. accord with the theory of Brunauer *et al.* (A., 1938, I, 190), from which vals. for the available surface are calc. F. J. G.

Mechanism of formation of Orange II alumina colour lakes. A. Voet (*J. Physical Chem.*, 1943, **47**, 191—196).—An investigation of the interaction of $\text{Al}(\text{OH})_3$ suspensions with Orange II solutions shows that all the dye is pptd. at pH <7 . Below pH 5.5 the lake is a pure Al salt; between pH 5.5 and 7 the lake is a mixture of Al salt and adsorbed dye. Above pH 7 only adsorption takes place. Adsorbed lakes contain no Na, and the phenomena must be explained as an exchange adsorption, hydrolytic adsorption being ruled out in view of the absence of any pH change. C. R. H.

Monolayers of compounds with branched hydrocarbon chains. VI. 2-[α]Methyl- and 10-[ϵ]methyl-substituted carboxylic acids of high mol. wt. S. Stållberg-Stenhagen and E. Stenhagen (*J. Biol. Chem.*, 1943, **148**, 685—694).—The condensed monolayers of long-chain acids substituted with α -Me- and ϵ -Me groups occupy an area 4—6 Å. $>$ the unsubstituted acids. An ϵ -Me group has little effect on surface moments, whilst the effect of an α -Me group is greater in condensed than expanded monolayers, and esterification of the α -methyl-acids greatly increases the surface moment. The force-area curves for condensed monolayers of branched-chain acids differ appreciably from those for straight-chain acids. P. G. M.

Foam and emulsion stabilities. S. Ross (*J. Physical Chem.*, 1943, **47**, 266—277).—The unit of foaminess for static foams (L_1) is redefined as the average length of time that unit vol. of liquid can remain suspended aloft as foam. This contrasts with the unit of foaminess for dynamic foams (Bikerman's Σ) which is the average length of time that unit vol. of gas remains in the foam. For static foams the unit corresponding to Σ is L_g . $L_1 = (1/V_0) \int_0^t t dV$ and

$L = (1/G_0) \int_0^t t dG$, where t = time, V and G are the vols. of liquid and gas respectively in the foam after time t , and V_0 and G_0 are the corresponding vols. when $t = 0$. For foams obeying the logarithmic relation for drainage the expression for L_1 simplifies to $t/2.3 \log(V_0/V)$. Foams of Aerosol OT and laurylsulphonic acid conform to this simplified relation. An approx. drainage equation has been developed and successfully applied to certain data on demulsification. The mechanism of demulsification is discussed. C. R. H.

Dissolution of gels. A. Tobolsky (*J. Chem. Physics*, 1943, **11**, 290—293).—The gel-liquid transition in three-dimensional cross-linked polymerides derived from long chain mols., swollen by suitable solvents, is reversible if carried out slowly and comparable with the melting of a solid. The "melting" temp. of a swollen gel is correlated with the entropy of disruption of the gel, which can be calc. from mol. consts. L. J. J.

Calculation of the degree of orientation of gels from refractometric measurements. A. Frey-Wyssling (*Helv. Chim. Acta*, 1943, **26**, 833—846).—Theoretical. Simple equations are given connecting n of a gel with its degree of orientation, this being represented by a single quantity, the scattering angle. The structure of Cellophane is discussed. F. J. G.

Coagulation of silicic acid gels compared with that of plasma.—See A., 1943, III, 680.

Softening of thermoplastic polymers. Theoretical.—See B., 1943, II, 257.

X-Ray investigation of the highly disperse state of division in a fibre. Cellulose model. R. Hosemann (*Z. Elektrochem.*, 1940, **46**, 535—550).—A method has been developed for determining the quant. particle size distribution from the intensity distribution in the central spot obtained in the X-ray diagram, using a monochromatic X-ray beam. The method assumes that the particles behave as rotation ellipsoids and is independent of whether the particles are crystallites, distorted crystallites, micelles, or amorphous conglomerates. $\text{C}_{31}\text{H}_{44}$ crystallites are very flat discs mainly 400 Å. high and of considerable breadth which apparently attains macroscopic dimensions. In cellulose fibres the upper limit of micelle thickness is 400 Å., the most frequent thickness being that of a single mol. chain; purified ramie has thinner micelles than the unpurified material. The length distribution max. occurs at 3000 and 200 Å. for ramie and cellulose triacetate, respectively. The latter val. is not in accord with that deduced from viscosity data. The results are discussed in relation to the structure of cellulose. J. W. S.

Reaction of wool with alkali.—See B., 1943, II, 249.

Acid-, base-, and salt-binding capacity of salt-denatured collagen. E. R. Theis and T. F. Jacoby (*J. Biol. Chem.*, 1943, **148**, 603—609).—KCl and CaCl_2 bind with collagen over a wide pH range, a max. val. being obtained in the isoelectric zone. CaCl_2 fixation is $>$ that for KCl at any given ionic strength but it produces shrinkage and contraction of the collagen. The isoionic point of CaCl_2 -treated collagen is shifted to a lower val., whilst that for KCl remains the same as for native collagen. J. E. P.

Migration data in solutions of a colloidal electrolyte. Laurylsulphonic acid. M. E. L. McBain (*J. Physical Chem.*, 1943, **47**, 196—204).—Electrolytic transference nos. (T.N.) of laurylsulphonic acid solutions (0.00116—0.3475M.) at 20° are recorded. At the lowest concn. there is practically complete dissociation into simple ions. T.N. increases rapidly with concn., attaining a max. val. of ± 0.351 at 0.0551M. With further increase in concn. T.N. falls rapidly up to ~ 0.07 M. and gradually thereafter. The max. T.N. is ~ 6 times the val. at the lowest concn. At the T.N. peak diffusion is at a min. and conductivity and osmotic coeff. are still diminishing. Over this range the colloid must contain much neutral material, mols., or ion pairs and the average composition must be continually

changing. A common misconception of the significance of transport of material in a colloid particle or complex ion as distinguished from the electrolytic T.N. is corr. C. R. H.

VI.—KINETIC THEORY. THERMODYNAMICS.

Dissociation constants of some acids in mixed solvents. J. C. Speakman (*J.C.S.*, 1943, 270—273).—Thermodynamic dissociation consts. at 20° for $([\text{CH}_2]_2\cdot\text{CO}_2\text{H})_2$, $(\text{CH}_2\cdot\text{CO}_2\text{H})_2$, $\text{CO}_2\text{H}\cdot[\text{CH}_2]_2\cdot\text{CO}_2\text{Me}$, *cis*-tetrahydronaphthalene-2:3-dicarboxylic acid, and BzOH in H_2O , EtOH , and aq. dioxan are in agreement with vals. calc. from the structure of the mol. Vals. for BzOH are independent of whether the cells have liquid junctions or not. F. R. G.

Ionisation constant of secondary magnesium phosphate. H. Tabor and A. B. Hastings (*J. Biol. Chem.*, 1943, 148, 627—632).—Conductivity data at 38° confirm the incomplete dissociation of MgHPO_4 in solution and are described by the equation $\text{p}K'_{\text{MgHPO}_4} = 2.87 - 4.15(\sqrt{\mu} - 0.5\mu)$. Intracellular electrolyte balance is discussed. The solubility product of MgHPO_4 , corr. for incomplete dissociation, is $\text{p}K'_{\text{s.p.}} = \sim 4.5$ at $\mu = 0.160$. J. E. P.

Provisional pH values for certain standard buffer solutions. R. G. Bates, W. J. Hamer, G. G. Manov, and S. F. Acree (*J. Res. Nat. Bur. Stand.*, 1942, 29, 183—190).—pH vals. at 20°, 25°, and 30° are recorded for a no. of standard buffer solutions. F. J. G.

Titration curves of hexameta- and tripoly-phosphoric acid. H. Rudy and H. Schloesser (*Ber.*, 1940, 73, [B], 484—492).—The titration curves of $(\text{NaPO}_3)_6$ and $(\text{NaPO}_3)_3$ obtained by addition of varied amounts of 0.1N-NaOH and determination of pH of the resulting solutions by the Pt- H_2 electrode show that $(\text{NaPO}_3)_6$ behaves like the Na salt of a strong monobasic acid and that it, like $(\text{NaPO}_3)_3$, has no buffering action towards alkalis. $\text{H}_5\text{P}_3\text{O}_{10}$ has three strong and two weaker acid groups and shows distinct buffering action at $\text{pH} > 4$. Comparison of the titration curves of $(\text{HPO}_3)_6$, $(\text{HPO}_3)_3$, H_3PO_4 , $\text{H}_4\text{P}_2\text{O}_7$, and $\text{H}_5\text{P}_3\text{O}_{10}$ gives no evidence of the existence of $\text{Na}_4\text{H}_2\text{P}_6\text{O}_{18}$. The first marked change of potential occurs almost simultaneously with all the acids and at this point 1, 2, 3, and 6 acid groups are satisfied in H_3PO_4 , $\text{H}_4\text{P}_2\text{O}_7$, $\text{H}_5\text{P}_3\text{O}_{10}$, and $(\text{HPO}_3)_6$ respectively; hence there is one strongly dissociated acid group for each P. If several OH are present, only the first is strongly dissociated. With regard to buffering action at $\text{pH} > 4.5$ the sequence is H_3PO_4 , $\text{H}_4\text{P}_2\text{O}_7$, $\text{H}_5\text{P}_3\text{O}_{10}$, $(\text{HPO}_3)_6$, and $(\text{HPO}_3)_3$. Removal of H_2O from H_3PO_4 causes loss of buffering action on the alkaline side. At $\text{pH} < 4.5$ and small concn. the buffering action of $(\text{HPO}_3)_6$ is slight. The constitution of $(\text{HPO}_3)_6$ and $\text{Na}_5\text{P}_3\text{O}_{10}$ is discussed. H. W.

Activity coefficients of thallos chloride in ethylene glycol-water solutions. O. D. Black and A. B. Garrett (*J. Amer. Chem. Soc.*, 1943, 65, 862—865).—The e.m.f. of the cell $\text{Ti-Hg}|\text{TiCl}|\text{AgCl}|\text{Ag}$ has been measured in H_2O , $(\text{CH}_2\cdot\text{OH})_2$, and $(\text{CH}_2\cdot\text{OH})_2\text{-H}_2\text{O}$ mixtures at 25°, and the solubility of TiCl in $(\text{CH}_2\cdot\text{OH})_2\text{-H}_2\text{O-KCl}$, $(\text{CH}_2\cdot\text{OH})_2\text{-KCl}$, $(\text{CH}_2\cdot\text{OH})_2\text{-H}_2\text{O}$, $\text{H}_2\text{O-morpholine}$, and $\text{H}_2\text{O-dioxan}$ mixtures at 25° has been determined. Activity coeffs., solubility product, and ionisation consts. of TiCl have been calc. from e.m.f. and solubility data. W. R. A.

Ethanol-water system. Vapour-liquid properties at high pressures. J. Griswold, J. D. Haney, and V. A. Klein (*Ind. Eng. Chem.*, 1943, 35, 701—704).—Vapour-liquid equilibrium and crit. temp. and pressure data for the system $\text{EtOH-H}_2\text{O}$ over the pressure range 1—75 atm. and temp. range 150—275° are recorded in tabular and diagrammatic form. C. R. H.

Equilibrium still for miscible liquids. Data on ethylene dichloride-toluene and ethanol-water. C. A. Jones, E. M. Schoenborn, and A. P. Colburn (*Ind. Eng. Chem.*, 1943, 35, 666—672).—New apparatus for determining vapour-liquid equilibria is described. Data are given for $\text{C}_2\text{H}_4\text{Cl}_2\text{-PhMe}$ and $\text{EtOH-H}_2\text{O}$ between their b.p./760 mm. and for $\text{EtOH-H}_2\text{O}$ at 50°/ and 60°/133—366 mm. M. H. M. A.

Composition of vapours from boiling binary solutions. D. F. Othmer (*Ind. Eng. Chem.*, 1943, 35, 614—620).—A detailed description is given of a standardised form of the author's apparatus (A., 1928, 943; 1932, 567), and its operation is discussed. Data are given for 26 systems. M. H. M. A.

System $\text{CaO-Al}_2\text{O}_3\text{-H}_2\text{O}$ at temperatures of 21° and 90°. L. S. Wells, W. F. Clarke, and H. F. McMurdie (*J. Res. Nat. Bur. Stand.*, 1943, 30, 367—409).—Metastable and stable solubility data are recorded for the system $\text{CaO-Al}_2\text{O}_3\text{-H}_2\text{O}$ at 21° and 90°. X-Ray examination shows that the so-called hexagonal tricalcium aluminate hydrate is an equimol. mixture of hexagonal $2\text{CaO}\cdot\text{Al}_2\text{O}_3\cdot 8\text{H}_2\text{O}$ (I) and hexagonal $4\text{CaO}\cdot\text{Al}_2\text{O}_3\cdot 13\text{H}_2\text{O}$ (II), cryst. in alternate layers. On keeping at room temp. (I) is slowly converted into (II) with separation of hydrated Al_2O_3 . Both are metastable with respect to isometric tricalcium aluminate, $3\text{CaO}\cdot\text{Al}_2\text{O}_3\cdot 6\text{H}_2\text{O}$. F. J. G.

Graphical interconversions for multicomponent systems. J. D. Leslie (*Ind. Eng. Chem.*, 1943, 35, 495—496).—The Sun and Silverman graphical methods of converting wt., vol., and mol. fractions

into one another have been extended from binary to multiple systems (cf. A., 1942, I, 293). C. R. H.

Interconversions of multicomponent compositions by graphical methods. K. H. Sun and A. Silverman (*Ind. Eng. Chem.*, 1943, 35, 497—498).—The authors' graphical methods for converting wt., vol., and mol. compositions in binary and ternary systems are extended to multicomponent systems (cf. preceding abstract). C. R. H.

Thermochemistry of alloys. F. Weibke (*Angew. Chem.*, 1940, 53, 74—80).—A lecture in which are described methods of determining the heat of formation of alloys and recent results obtained for Ca-Pb and Au-Cu alloys. Ca_2Pb has a heat of formation of 47 kg.-cal. per mol. and reacts with Pb to form CaPb liberating 3 kg.-cal. The formation of AuCu , Au_2Cu_3 , and AuCu is shown by well-marked peaks in the heat of formation-composition graph. A. R. P.

Heat of formation of manganomanganic oxide and manganese dioxide. C. H. Shomate (*J. Amer. Chem. Soc.*, 1943, 65, 785—790).— $\Delta H_{298.15}$ vals. are $\text{Mn}_3\text{O}_4 - 331,650 \pm 250$; $\text{MnO}_2 - 124,640 \pm 200$ g.-cal per mol. W. R. A.

Heats of formation of natural and artificial carbonates. W. A. Roth, H. Berendt, and G. Wirths (*Z. Elektrochem.*, 1941, 47, 185—190).—The heats of formation at 20° of calcite, MnCO_3 , malachite, and azurite, calc. from heat changes on dissolution in acid, are $+42.45 \pm 0.05$, $+15.07 \pm 0.09$, $+13.78 \pm 0.09$, and $+20.88 \pm 0.14$ kg.-cal., respectively. Comparison with published vals. is made, and the accuracy of published vals. for the heats of formation of other compounds is discussed. C. R. H.

Heats of formation of cadmium halide compounds with amines. W. Huber and E. Reindl (*Z. Elektrochem.*, 1940, 46, 556—558).—Mol. heats of formation at 20° from solid halide and liquid or (in parentheses) gaseous amine are: $\text{CdCl}_2\cdot 2\text{C}_5\text{H}_5\text{N}$ 21.47 (40.89), $\text{CdBr}_2\cdot 2\text{C}_5\text{H}_5\text{N}$ 20.86 (40.28), $\text{CdI}_2\cdot 2\text{C}_5\text{H}_5\text{N}$ 20.31 (39.73), $\text{CdBr}_2\cdot 6\text{C}_5\text{H}_5\text{N}$ 38.09 (96.25), $\text{CdI}_2\cdot 6\text{C}_5\text{H}_5\text{N}$ 40.80 (99.06), $\text{CdCl}_2\cdot \text{en}_3$ 51.86 (85.46), $\text{CdBr}_2\cdot \text{en}_3$ 50.36 (83.96), and $\text{CdI}_2\cdot \text{en}_3$ 49.60 (83.20) kg.-cal. per g.-mol. The results are discussed in relation to data for Zn and Hg halide compounds with amines and for compounds with NH_3 . J. W. S.

Heats of formation and constitution of molecular compounds of stannic chloride. W. Hieber and E. Reindl (*Z. Elektrochem.*, 1940, 46, 559—570).—From v.p. measurements over the temp. range 30—200° the following mean heats of vaporisation at 0—100° are deduced: SnCl_4 9.24, $\text{Et}_2\text{C}_2\text{O}_4$ 11.86, Et_2 malonate 12.35, succinate 13.05, glutarate 13.40, adipate 14.16, sebacate 14.68, and EtOBz 11.90. Mol. heats of formation at 0° from the liquid or (in parentheses) gaseous components are $\text{SnCl}_4\cdot\text{Et}_2\text{C}_2\text{O}_4$ 18.98 (40.03), $\text{SnCl}_4\cdot\text{CH}_2(\text{CO}_2\text{Et})_2$ 22.48 (44.07), $\text{SnCl}_4\cdot(\text{CH}_2\cdot\text{CO}_2\text{Et})_2$ 20.33 (42.62), $\text{SnCl}_4\cdot[\text{CH}_2]_3(\text{CO}_2\text{Et})_2$ 21.60 (44.24), $\text{SnCl}_4\cdot[\text{CH}_2]_4(\text{CO}_2\text{Et})_2$ 23.49 (46.89), $\text{SnCl}_4\cdot[\text{CH}_2]_5(\text{CO}_2\text{Et})_2$ 23.19 (47.20), $\text{SnCl}_4\cdot 2\text{EtCO}_2\text{Et}$ 23.47 (50.33), $\text{SnCl}_4\cdot 2\text{EtOBz}$ 20.15 (53.19), $\text{SnCl}_4\cdot 2\text{EtOH}$ ~ 22.31 (~ 52.37), $\text{SnCl}_4\cdot 2\text{Et}_2\text{O}$ 25.80 (48.44) and $\text{SnCl}_4\cdot 2\text{NH}_2\text{Ph}$ 33.59 (62.35) kg.-cal. per g.-mol. The m.p. of these complexes are 85°, 121.5°, 111.5°, 95.5°, 79.5°, 62°, 48°, 47°, 92°, 82°, and $> 220^\circ$ (decomp.), respectively. It is inferred that the Sn atom has co-ordination no. 6 in each of these compounds, whilst the association of the compounds with dibasic acids in org. solvents indicates that they must exist in the dimeric form with each Sn co-ordinated to two O atoms of different acid mols. J. W. S.

Heat of combustion of benzoic acid with special reference to the standardisation of bomb calorimeters. R. S. Jessup (*J. Res. Nat. Bur. Stand.*, 1942, 29, 247—270).—The heat of combustion per g. of BzOH under the conditions of standard bomb calorimetry is 26428.4 International joules. F. J. G.

Heats of dilution and relative heat contents of lanthanum chloride and sulphate solutions. C. C. Nathan, W. E. Wallace, and A. L. Robinson (*J. Amer. Chem. Soc.*, 1943, 65, 790—794).—Heats of dilution in H_2O at 25° of LaCl_3 between 6×10^{-5} and 0.1M. and of $\text{La}_2(\text{SO}_4)_3$ between 2×10^{-5} and 0.025M. have been determined, and the relative partial molal heat contents have been calc. Results do not agree with Debye-Hückel theory even at the lowest concns. W. R. A.

Thermodynamics and molecular structure of benzene and its methyl derivatives. II. Thermodynamic measurements on mixed systems. Equilibrium and heat content relationships between benzene, toluene, and each of the xylenes. F.p. diagram of the system, o-, m-, and p-xylenes. V. Statistically calculated thermodynamic quantities. Internal rotation of methyl groups attached to a benzene ring. General discussion. K. S. Pitzer and D. W. Scott (*J. Amer. Chem. Soc.*, 1943, 65, 811—814, 824—829).—II. By using m.p. and heats of fusion (cf. A., 1943, I, 223) with thermodynamics and Raoult's law the f.p. diagram of the xylenes has been calc. Xylene mixtures were analysed by measuring n . The equilibrium composition of xylene at 50° is o- 12 ± 3 , m- 71 ± 5 , and p- $17 \pm 2\%$. Equilibrium measurements on the reaction $2\text{PhMe} \rightleftharpoons \text{C}_6\text{H}_6 + \text{C}_6\text{H}_4\text{Me}_2$ at 50° with anhyd. $\text{AlBr}_3 + \text{HBr}$ as a catalyst are given, and thermodynamic

consts. are evaluated for $m \rightarrow p$; $m \rightarrow o$; $p \rightarrow o$; $m \rightarrow$ (equilibrium) -xylene; $2\text{PhMe} \rightarrow \text{C}_6\text{H}_6 + m$ - (and equilibrium) -xylene.

V. Statistically calc. vals. for $S_{298.16^\circ}$ for gaseous C_6H_6 , PhMe , o -, m -, and p -xylene, and mesitylene are compared with experimental vals., and potential barriers restricting free rotation in the mols. have been computed. In PhMe and m - and p -xylene, the Me groups rotate relatively freely, but in o -xylene there is a barrier of ~ 2000 g.-cal. From the equilibrium data the m -compound has the lowest energy, and it is suggested that m -orientation of identical or similar groups may be generally the most stable. The estimated entropies of 1 : 2 : 4- $\text{C}_6\text{H}_2\text{Me}_3$ and 1 : 2 : 4 : 5- $\text{C}_6\text{H}_2\text{Me}_4$ are reported.

W. R. A.

Entropy and irreversible processes. W. Ehrenberg (*Phil. Mag.*, 1943, [vii], 34, 396—409).—Mathematical. From an analysis of the notion "body" in thermodynamics, irreversible processes are classified as "conduction" and as "breaking-up" processes. A new derivation, from the Clausius principle, of $dS = dQ/T$ shows that this relation holds for irreversible "conduction" processes as well as for reversible processes. Bridgman's hypothesis, the theory of Carathéodory and Born, and the bearing of the new derivation on the interpretation of the equilibrium conditions are discussed.

N. M. B.

Absolute values of entropies of aqueous ions. F. H. Lee and Y. K. Tai (*J. Chinese Chem. Soc.*, 1941, 8, 60—63).—From the temp. coeffs. of the potentials of the capillary electrometer and H_2 electrode against the Hg_2Cl_2 electrode the abs. entropy of the aq. H^+ ion is calc. to be -5.4 entropy units. Utilising this val. the abs. entropies of other ions are calc. The application of these vals. to the verification of the theoretically deduced entropies of hydration of gaseous ions is illustrated for K^+ .

J. W. S.

VII.—ELECTROCHEMISTRY.

Mobility of the ferrocyanide ion in aqueous solution at infinite dilution. E. Asmus (*Z. Elektrochem.*, 1940, 46, 596—599).—The viscosity (η) of aq. $\text{Na}_4\text{Fe}(\text{CN})_6$ has been measured over the concn. (c) range 0.0003—0.012M. at 25° and vals. of the function $\phi = (\eta/\eta_0 - 1)/c^{0.5}$ are evaluated. The limiting val. of ϕ at $c \rightarrow 0$ is deduced graphically as 0.0405, in accord with the vals. deduced theoretically using 51 and 101 as the equiv. conductivities of Na^+ and $\text{Fe}(\text{CN})_6^{4-}$, respectively, thus confirming Hölzl's val. of the mobility of $\text{Fe}(\text{CN})_6^{4-}$ (A., 1930, 1253). Ageing of the solutions leads to lower vals. of ϕ .

J. W. S.

High mol. wt. aliphatic amines and their salts. XI. Transference numbers of primary aliphatic amine hydrochlorides in aqueous solution and their significance in the interpretation of the micelle theory. C. W. Hoerr and A. W. Ralston (*J. Amer. Chem. Soc.*, 1943, 65, 976—983).—Transference nos. of n -primary aliphatic amine hydrochlorides containing 8, 10, 12, 14, 16, and 18 C, in H_2O at 60° , and of dodecylammonium chloride at 20° , 30° , and 40° , have been determined. The results indicate the formation of both ionic and lamellar micelles, the latter name being given to large aggregates of undissociated mols. formerly called "neutral colloid."

W. R. A.

Transference phenomena in molten salts. K. E. Schwarz (*Z. Elektrochem.*, 1941, 47, 144—147).—Electrolytic transference in the systems $\text{Pb}|\text{PbCl}_2 + \text{PbI}_2|\text{Pb}$ and $\text{Sn}|\text{SnCl}_2 + \text{SnI}_2|\text{Sn}$ and diffusion potential data for the system $\text{Ag}|\text{AgNO}_3|\text{AgNO}_3 + \text{Ag halide}|\text{Ag}$ agree with predictions on the basis of the author's theory (cf. A., 1940, I, 27).

C. R. H.

E.m.f. measurements in liquid sulphur dioxide. K. Cruse (*Z. Elektrochem.*, 1940, 46, 571—590).— $\text{Pb}-\text{PbCl}_2$, $\text{Hg}-\text{Hg}_2\text{Cl}_2$, $\text{Ag}-\text{AgCl}$, $\text{Ag}-\text{AgBr}$, and $\text{Pt}-\text{H}_2$ electrodes suitable for use in liquid SO_2 are described. The e.m.f. of the cells $\text{Pb}, \text{PbCl}_2|\text{SO}_2 + 0.1\text{M}-\text{NH}_4\text{Et}_2\text{Cl}|\text{Hg}_2\text{Cl}_2, \text{Hg}$ and $\text{Ag}, \text{AgCl}|\text{SO}_2 + 0.1\text{M}-\text{NH}_4\text{Et}_2\text{Cl}|\text{Hg}_2\text{Cl}_2, \text{Hg}$ increase slowly with time and it is shown that of electrodes of this type only $\text{Ag}-\text{AgCl}$ is reliable, being almost free from change of potential with time. The $\text{Pt}-\text{H}_2$ electrode operates very well in liquid SO_2 but the $\text{Pt}-\text{O}_2$ electrode is unsatisfactory. The effects of the $[\text{HCl}]$ or $[\text{HBr}]$ on the e.m.f. of the cells $\text{Ag}, \text{AgCl}|\text{SO}_2 + \text{HCl}|\text{H}_2, \text{Pt}$ and $\text{Ag}, \text{AgBr}|\text{SO}_2 + \text{HBr}|\text{H}_2, \text{Pt}$ have been investigated. In all cases the e.m.f. are $>$ the theoretical vals. The results are discussed in relation to Brönsted's theory of acids and bases.

J. W. S.

Stages of oxidation of ruthenium. II. Oxidation potential $\text{Ru}^{III} \rightleftharpoons \text{Ru}^{IV}$ in hydrochloric acid solution. G. Grube and G. Fromm (*Z. Elektrochem.*, 1941, 47, 208—211).—The $\text{Ru}^{III} \rightleftharpoons \text{Ru}^{IV}$ oxidation potentials at 25° in HCl solutions of $\text{RuCl}_3-\text{RuCl}_4$ mixtures (0.034 g.-mol. of Ru per l.) are 0.858, 0.874, 0.908 v. in 2.0, 1.1, and 0.5N- HCl respectively, showing that oxidation is not solely explained by changes in potential of Ru ions, but is influenced by HCl .

C. R. H.

Apparatus for determination of oxidation-reduction potential and hydrogen-ion concentration *in vivo* by a single puncture.—See A., 1943, III, 704.

Polarisation at oxidation-reduction electrodes. I. Ferrocyanide-ferricyanide electrode. W. R. Carmody and J. J. Rohan (*Trans.*

Electrochem. Soc., 1943, 83, *Preprint*, 11, 137—145).—Chemical polarisation is ~ 0.2 v. per amp. per cm^2 at smooth Pt and somewhat less at platinised Pt and at Au , with the $\text{Fe}(\text{CN})_6^{4-}-\text{Fe}(\text{CN})_6^{3-}$ electrode as anode or as cathode using c.d. < 100 ma. per cm^2 .

F. R. G.

Polarography of stannous and cupric tartrate complexes. Amperometric titration of tin with cupric ion. J. J. Lingane (*J. Amer. Chem. Soc.*, 1943, 65, 866—872).—Polarograms of the Sn^{II} tartrate complex in tartrate solutions include a cathode wave due to reduction to Sn , and an equal anode wave from the oxidation to Sn^{IV} , both reactions being irreversible. A min. in the anodic diffusion current has been observed in acid media. The half-wave potential is discussed in relation to pH and the nature of the complex. In acid tartrate solutions the Cu^{II} tartrate complex gives a cathode wave, but in alkaline media the latter is masked by the discharge of Na^+ . The amperometric titration of Sn^{II} with Cu^{II} in tartrate solutions, in which the anode diffusion current of Sn^{II} is compensated by the cathode diffusion current of Cu^{II} , is described.

W. R. A.

VIII.—REACTIONS.

Correlation of rate data. C. C. DeWitt (*Ind. Eng. Chem.*, 1943, 35, 695—700).—Mathematical. The application of equations of growth to chemical engineering problems is considered.

C. R. H.

Transmission coefficient in the theory of absolute reaction rates. H. M. Hulburt and J. O. Hirschfelder (*J. Chem. Physics*, 1943, 11, 276—290).—Transmission coeffs. are computed quantum-mechanically for a no. of idealised energy surfaces. Quantum effects are small at room temp. where isotope separation is not involved. The use of classical mechanics in Eyring's theory of rate processes is justified.

L. J. J.

Interaction of the van der Waals type between three atoms. B. M. Axilrod and E. Teller (*J. Chem. Physics*, 1943, 11, 299—300).—Van der Waals interaction between three atoms is calc. by a perturbation method.

L. J. J.

Does a measurable excess of translational or of internal molecular energy occur when gases burn explosively? H. Zeise (*Z. Elektrochem.*, 1941, 47, 172—177).—Discussion.

C. R. H.

Thermal hydrogen-oxygen reaction; measurements in large vessels. O. Oldenberg and J. E. Morris (*J. Chem. Physics*, 1943, 11, 247).—Measurements of the upper explosion limit of H_2-O_2 mixtures as a function of temp. in the range $400-500^\circ$, in small and large (4 l.) vessels with KCl , BaCl_2 , and Pyrex surfaces, are recorded. The limiting pressure for explosion increases with temp., but the effect of size of vessel is insignificant. Vals. are lower in KCl than in Pyrex vessels.

L. J. J.

Influence of turbulence on flame velocity in gaseous mixtures. G. Damköhler (*Z. Elektrochem.*, 1940, 46, 601—626).—Experiments on the influence of turbulence on the velocity of flame propagation in $\text{C}_3\text{H}_8-\text{O}_2$ mixtures are described, and a mathematical treatment of the subject is presented.

C. R. H.

Reaction kinetics of the "knocking" process. II. Spontaneous ignition of hydrocarbon-air mixtures and "knocking." H. Teichmann. III. Effect of added substances on the spontaneous ignition of adiabatically compressed heptane-air mixtures. W. Jost and H. Rögener (*Z. Elektrochem.*, 1941, 47, 297—307, 307—309).—II. An apparatus for the study of the combustion of adiabatically compressed mixtures of inflammable substances and air is described. "Knocking," after spark ignition, has been investigated by photographically recording the flames. Induction times and energies of activation for the ignition by adiabatic compression of hydrocarbon-air mixtures have been determined. Vals. of the latter are 30—50 kg.-cal.

III. Addition of amyl nitrite, EtNO_2 , or acetone peroxide increases the inflammability of C_5H_{12} -air mixtures. NH_2Ph and $\text{Fe}(\text{CO})_5$ retard the ignition. The influence of PbEt_4 could not be unequivocally established. It is considered that the mild conditions of C_5H_{12} ignition are insufficient to cause the decomp. of PbEt_4 to the "antiknock"-active substance.

W. R. A.

Rate of decomposition of hydrogen peroxide in concentrated solutions. R. Livingston (*J. Physical Chem.*, 1943, 47, 260—264).—Conc. H_2O_2 (80—83%) in Pyrex vessels decomposes at the rate of 3×10^{-7} mol. per l. per sec. at 25° . With glyptal-varnished vessels decomp. is 2—3 times as fast, and with vessels lined with bakelite or tetracosane decomp. is extremely rapid. With Sn -lined vessels decomp. is slow after an initial rapid period. Removal of dust or addition of H_4SnO_4 or 2% H_2SO_4 increases stability. Decomp. proceeds by at least two independent processes. One of these is not inhibited by H_4SnO_4 or H_2SO_4 or by removing dust. The decomp. rate is 2.6×10^{-7} mol. per l. per sec. and the heat of activation is $< 16,000$ g.-cal. per mol. The other process, which is predominant in ordinary solutions, is inhibited by H_4SnO_4 and H_2SO_4 and catalysed by dust, and its heat of activation is $> 20,000$ g.-cal. per mol.

C. R. H.

Kinetics of aromatic halogenation. I. Bromination. P. W. Robertson, P. B. D. de la Mare, and W. T. G. Johnston. **II. Chlorination of hydrocarbons.** P. B. D. de la Mare and P. W. Robertson (*J.C.S.*, 1943, 276—279, 279—281).—I. Bromination of *o*-0.025M-NHAcPh, *p*-C₆H₄Me-NHAc, mesitylene, PhOMe, and *p*-C₆H₄Me-OMe in AcOH is a third-order reaction which at lower concn. or by addition of H₂O becomes of second order, and with addition of CHCl₃ or CCl₄ of a higher order involving chain reactions.

II. Rates of chlorination of PhR in AcOH are in the order R = Me > Et > Pr^β > Bu^γ. Vals. are also recorded for *o*-, *m*-, and *p*-xylene, C₆H₃Me₃, and C₆HMe₅. F. R. G.

Mechanism of reaction between alkyl halides and hydroxylic solvents. III. Reactions of *n*-butyl bromide. M. L. Bird, E. D. Hughes, and C. K. Ingold (*J.C.S.*, 1943, 255—261).—Vals. calc. for both rate of reaction and composition of the products in the solvolysis of BuⁿBr on the basis of a single pair of consts. agree with experimental results obtained in MeOH and MeOH-H₂O at 59.4°, and in EtOH-H₂O at 75.1°, confirming that these reactions are bimol.

A. L.

Reduction of ammonium molybdate by sodium hydrogen *l*-ascorbate in the dark. S. K. Bhattacharyya and A. R. Sur (*J. Indian Chem. Soc.*, 1942, 12, 514—515).—The velocity of reduction of (NH₄)₂MoO₄ (I) by Na H *l*-ascorbate (II) is a max. when (I) and (II) are in equiv. concn., indicating that it is α the concn. of a complex.

F. J. G.

Velocity of fission of glycols with lead tetra-acetate in relation to the solvent. R. Criegee and E. Büchner (*Ber.*, 1940, 73, [B], 563—571; cf. A., 1933, 1272).—Velocity coeffs. (*k*₂₀) are recorded for reaction of Pb(OAc)₄ and *cis*-cyclohexanediol in AcOH with various addenda (the accelerating effect of the latter is in the order H₂O > MeOH > COMe₂, EtOAc > C₆H₆, *trans*-dimethylacenaphthenediol in MeOH-AcOH (1 : 1), and mandelic acid in 99.5% AcOH, and curves showing increase of *k* with increasing additions of MeOH to AcOH are given for several other diols. Hydrobenzoin is oxidised by Pb₃O₄-2N-HNO₃ to PhCHO; pinacone hydrate affords COMe₂ similarly. The reaction mechanisms are discussed.

A. T. P.

Velocity of fission of glycols with lead tetra-acetate in relation to the constitution of glycol. R. Criegee, E. Büchner, and W. Walther (*Ber.*, 1940, 73, [B], 571—575; cf. A., 1933, 1272).—Vals. of *k*₂₀ and *k*₃₀ are tabulated for 17 diols; they decrease in the order *cis*-cyclopentanediol > dimethylcamphanediol > isohydrobenzoin > cycloheptanonepinacone > tetrabenzonaphthalene glycol > dimethyldihydrophenanthrenediol, hydrobenzoin, fluorenonepinacone > *cis*-decahydronaphthalene-9 : 10-dione > *trans*-cyclopentanediol > cyclohexanonepinacone > *trans*-decahydronaphthalene-2 : 3-diol (I) of m.p. 140° > *trans*-decahydronaphthalene-9 : 10-diol > cyclopentanonepinacone > (I) of m.p. 163° > *d*-camphorpinacone > camphenilonepinacone, and the relation between reaction velocity and mol. structure is discussed.

A. T. P.

Kinetics of co-polymerisation. H. Branson and R. Simha (*J. Chem. Physics*, 1943, 11, 297—298).—Co-polymerisation is discussed on the basis of a steady-state method with termination involving radical chain and a stable monomeride.

L. J. J.

Restriction of the catalysed oxidation of the iodine ion by chlorate. III. Osmium tetroxide and ferric chloride as catalyst. K. Weber and M. Pichler (*Ber.*, 1940, 73, [B], 415—423).—OsO₄ is the best catalyst for the reaction, 6I⁻ + ClO₃⁻ + 6H⁺ = 3I₂ + Cl⁻ + 3H₂O, being in the initial stages about 20 times as powerful as RuCl₃. With increasing [HCl] the rate of reaction increases initially, but the subsequent decrease in the rate is more pronounced. The increase is more marked than corresponds with direct proportionality with [HCl], less marked than is required by [HCl]². At 13.5°, 25°, and 40° there is little increase in the rate of reaction with increasing temp. and such increase diminishes with time and ultimately at 40° changes to a decrease. The velocity coeff. appears to be α log [OsO₄]. The rate of the catalysed reaction is greatly lessened by NiSO₄, Co⁺⁺, and SO₄⁺⁺, the influence being of the same order as observed with RuCl₃. Cl⁻ has little effect and Na⁺ is without action, Mn⁺⁺ has a slight accelerating effect. The catalytic activity of FeCl₃ is not very pronounced. HCl appears to cause a great acceleration due to the accumulation of H⁺ in the neighbourhood of I⁻ and a less pronounced restriction by inactivation of the catalyst by repression of the slight hydrolysis. The temp. coeff. of the change is not quite normal. Direct proportionality between rate of reaction and [FeCl₃] is observed. NiSO₄, CoSO₄, MnSO₄, Na₂SO₄, NaCl, and Mn(NO₃)₂ restrict the change slightly but MnCl₂ causes a slight acceleration.

H. W.

Kinetics in acid media. Condensation of *o*-benzoylbenzoic acid. C. W. Deane with J. R. Huffman (*Ind. Eng. Chem.*, 1943, 35, 684—694).—The condensation of *o*-C₆H₄Bz-CO₂H to anthraquinone (I) in the presence of conc. H₂SO₄ and oleum is a unimol. reaction. It is catalysed by SO₃ and inhibited by H₂O and to a greater extent by (I). The average energy of activation (*E*) is 26,100 g.-cal., *E* decreasing slightly with increase in [SO₃]. The temp. coeff. for a 10° rise (75—85°) is ~3. Reaction mechanisms and the application of the data to problems involved in the commercial prep. of (I) are discussed.

C. R. H.

Effects of high pressure on the inversion of sucrose and the mutarotation of glucose.—See A., 1943, III, 683.

Chemical interpretation of the mechanism of oxidation by dehydrogenase systems.—See A., 1943, III, 596.

Kinetics of ammonia synthesis. P. H. Emmett and J. T. Kummer (*Ind. Eng. Chem.*, 1943, 35, 677—683).—Temkin and Pishev's theory of the catalytic synthesis and decomp. of NH₃ (cf. A., 1942, I, 207) is discussed and applied to data on the rate of NH₃ synthesis as a function of gas composition, pressure, space velocity, and temp. Agreement between observation and theory is very close, although the theory does not appear to be applicable to catalysts singly promoted with Al₂O₃.

C. R. H.

Cyanide-cyanamide equilibrium in the case of lithium. A. Perret and J. Riethmann (*Helv. Chim. Acta*, 1943, 26, 740—746).—LiCN is unchanged at high temp. in the absence of catalysts, but in presence of Fe the reaction 2LiCN = C + Li₂CN₂ occurs. LiCN is stable at >1000°, Li₂CN₂ is stable at <600°, and at intermediate temp. LiCN and Li₂CN₂ are in equilibrium. When Li₂C₂ is heated in NH₃, or when LiN₃ is heated with C, the product is Li₂CN₂ at <700°; at higher temp. increasing amounts of LiCN are also formed.

F. J. G.

Anodic oxidation of aluminium and aluminium alloys.—See B., 1943, I, 342.

Separation of metals by the mercury cathode: chromium. R. C. Chirside, L. A. Dauncey, and P. M. C. Proffitt (*Analyst*, 1943, 68, 175—180).—In presence of (NH₄)₂SO₄ the rate of deposition of Cr is increased by high c.d., high temp., use of conc. solutions, and min. acidity, but decreased by rotation of the anode and addition of reducing agents. K and Na have no effect. Small amounts of Ni and traces of Ag facilitate complete deposition of Cr even in the presence of much (NH₄)₂SO₄. Cu and Fe do not interfere.

S. B.

Hard chromium-plating of aluminium and its alloys.—See B., 1943, I, 342.

Electrolysis with alternating current superposed on direct current (undulating current); reduction of nitrocarbamide to semicarbazide. E. Briner and E. Hoefer (*Helv. Chim. Acta*, 1943, 26, 913—922).—In the electrolytic reduction of nitrocarbamide to semicarbazide, superposition of a.c. on d.c. reduces the yield with bright Pt electrodes but not with black Pt.

F. J. G.

Optical sensitising of silver halides by dyes. IV. Optical sensitising properties of fluorescein dyes in relation to their spectral absorption and constitution. S. E. Sheppard, R. H. Lambert, and R. D. Walker (*J. Chem. Physics*, 1943, 11, 263—275; cf. A., 1941, I, 172).—The visible and first ultra-violet absorption bands of halogenated fluoresceins move towards longer λλ with increasing halogen content, whilst acid dissociation consts. of ·OH and ·CO₂H become indistinguishable and solubilities of Ag compounds decrease. The half-degree of adsorption of fluorescein dyes on Ag halides does not coincide with the isoelectric pAg of the Ag halide. Deviation from the Langmuir isotherm at low and approach to agreement at high adsorption densities can be explained by assuming an accommodation coeff. in adsorption, making the average life of adsorbed mols. dependent on adsorption density. Adsorption saturation of erythrosin agrees with an edge-on or end-on monolayer. Electro-metric titration and dilution of suspensions give 4.55 × 10⁻⁶ and 4.6—4.8 × 10⁻⁶ mols. per l., respectively, for solubility of Ag erythrosinate; the val. decreases with ageing and with adsorption on AgBr, and varies with particle size. Evidence favours energy rather than electron transfer as the basis of sensitisation.

L. J. J.

Photobromination of cinnamic acid in ultra-violet light of 254 mμ. J. C. Ghosh and S. K. Bhattacharyya (*J. Indian Chem. Soc.*, 1942, 12, 503—506).—The reaction between Br and cinnamic acid (I) in CCl₄ solution in light of λ 254 mμ. is unimol. with respect to Br and to (I). The rate α the intensity of radiation absorbed by (I), and the quantum efficiency and temp. coeff. are both >1. A mechanism involving activated mols. of (I) is proposed.

F. J. G.

Photochemical oxidation of mandelic acid by bromine with tungstic acid sol as sensitiser in ultra-violet light of 254 mμ. J. C. Ghosh, S. K. Bhattacharyya, and K. R. Kar (*J. Indian Chem. Soc.*, 1942, 12, 507—509).—The oxidation of mandelic acid (I) in aq. solution by Br with H₂WO₄ sol as sensitiser in light of λ 254 mμ. is unimol. with respect to Br and to (I). The rate is independent of [Na₂WO₄] at const. pH, and is a min. at pH 4.05. It is α the intensity of light absorbed by the sol. The temp. coeff. is small and the quantum efficiency is between 1 and 7.

F. J. G.

Photochemical reactions between ammonium molybdate and various organic reducing agents in [light of] wave-length 366 mμ. S. K. Bhattacharyya, K. R. Kar, and A. R. Sur (*J. Indian Chem. Soc.*, 1942, 12, 510—513).—In light of λ 366 mμ., tartaric, lactic, and mandelic acids reduce (NH₄)₂MoO₄ to various coloured products. Some observations on the rate of the reaction are recorded. It is independent of the state of polarisation of the light.

F. J. G.

Destruction of pyridoxine by light.—See A., 1943, III, 577.

IX.—PREPARATION OF INORGANIC SUBSTANCES.

Metastable oxygen and biological formation of hydrogen peroxide.—See A., 1943, III, 699.

Statistics of isotope distribution in condensed particles. Requirements for a separation of isotopes on the basis of density variations of condensed particles. L. Holleck (*Z. Physik*, 1940, **116**, 624—631).—The possibility of making use of density variations in condensed particles to effect a separation of isotopes by sedimentation or centrifuging has been investigated statistically. Calculation shows that for ^7Li and ^6Li , the frequency with which variation in density occurs, even in particles of colloidal size, is so small as to make the method quite impracticable. A. J. M.

Compounds of gallium. V. Gallium alizarin lakes, gallium salts of geometrically and optically isomeric acids, and double sulphates with ethylene- and propylene-diamine sulphates. P. Neogi and K. L. Mondal (*J. Indian Chem. Soc.*, 1942, **12**, 501—502).—*Ga alizarate*, $\text{Ga}(\text{C}_{14}\text{H}_7\text{O}_4)_3$, *Ga Ca alizarate*, $\text{Ga}_2\text{Ca}_3(\text{C}_{14}\text{H}_7\text{O}_4)_6$, *Ga maleate*, $\text{Ga}_2(\text{C}_4\text{H}_2\text{O}_4)_3 \cdot 2\text{H}_2\text{O}$, *Ga d- and l-camphorsulphonate*, $\text{Ga}(\text{C}_{10}\text{H}_{15}\text{SO}_4)_3 \cdot 3\text{H}_2\text{O}$, $[\alpha]_D^{25} +18.6^\circ$, -19° , *ethylenediammonium Ga sulphate*, $\text{Ga}_2(\text{SO}_4)_3 \cdot \text{C}_2\text{H}_4(\text{NH}_3)_2 \cdot \text{SO}_4 \cdot 12\text{H}_2\text{O}$, and *propylenediammonium Ga sulphate*, $\text{Ga}_2(\text{SO}_4)_3 \cdot \text{C}_3\text{H}_6(\text{NH}_3)_2 \cdot \text{SO}_4 \cdot 12\text{H}_2\text{O}$, are described. F. J. G.

Reactions in solid state. III. Reaction between sodium carbonate and quartz. G. Gibson and R. Ward (*J. Amer. Ceram. Soc.*, 1943, **26**, 239—246).—Reaction at 726—805° between Na_2CO_3 and quartz (<325-mesh, 5—7 and 2—3 μ) was conducted in a stream of N_2 . The reaction rate and end products for mixtures of mol. ratio $\text{Na}_2\text{CO}_3:\text{SiO}_2$ of 1:1 to 1:2.5 were determined. The rate of reaction and the nature of the product were affected by the size of the batch, the rate of gas flow, and the duration of the reaction. In presence of sufficient Na_2CO_3 the product at the higher temp. was $2\text{Na}_2\text{O} \cdot \text{SiO}_2$ but compounds intermediate between $\text{Na}_2\text{O} \cdot \text{SiO}_2$ and $2\text{Na}_2\text{O} \cdot \text{SiO}_2$ appear to be formed by interaction between $\text{Na}_2\text{O} \cdot \text{SiO}_2$ and Na_2CO_3 . The latter reaction is postulated to be reversible with the smaller ions. This theory is used to explain certain anomalies. The rate of evolution of CO_2 is not a criterion of the rate of reaction of the SiO_2 particles. J. A. S.

Acidity of silicofluorides. K. Uhl and K. Klumpner (*Angew. Chem.*, 1943, **15**, 188—189).—pH vals. obtained during the progressive neutralisation and decomp. of aq. H_2SiF_6 by aq. NH_3 , KOH , NaOH , $\text{Mg}(\text{OH})_2$, $\text{Ca}(\text{OH})_2$, and $\text{Ba}(\text{OH})_2$ are recorded, and discussed in relation to the applications of fluorides and silicofluorides in plant physiology. L. S. T.

Conductometric elucidation of complex chromium cations. I. Theoretical. II. Structure and properties of chromium sulphate complexes. S. G. Shuttleworth (*J. Soc. Leather Trades' Chem.*, 1943, **27**, 104—111, 111—116).—I. Equations are derived to calculate the amount of hydrolysed acid and the distribution of acid and OH groups inside and outside the Cr complex from conductometric titration curves.

II. Boiled 33 $\frac{1}{3}\%$ basic SO_2 -reduced Cr sulphate liquors contain all the SO_4^{2-} and OH^- inside the complex. This liquor made 66 $\frac{2}{3}\%$ basic by the addition of NaOH still contains the SO_4^{2-} inside the complex but 25% of the OH^- is attached electrovalently to the Cr complex. Freshly prepared unheated Cr alum solution contains only electrovalent groups. Boiled Cr alum solutions consist of mixtures of electrovalent Cr sulphate and the above 33 $\frac{1}{3}\%$ basic Cr complex. The proportion of 33 $\frac{1}{3}\%$ basic Cr complex is 50% at m./6 concn. and 75% at 0.01M. D. P.

Preparation and properties of ammonium diuranate. H. W. Safford and A. Kuebel (*J. Chem. Educ.*, 1943, **20**, 88—91).—A procedure for the industrial extraction of $(\text{NH}_4)_2\text{U}_2\text{O}_7 \cdot x\text{H}_2\text{O}$ (I) from pitchblende, and a duplication on the laboratory scale, are described. (I) dried in air at room temp., or over CaSO_4 , and $(\text{NH}_4)_2\text{U}_2\text{O}_7$ dried at 100° for 3 weeks, have practically identical X-ray diffraction patterns. Reddish-brown UO_3 is formed by heating (I) in air at $\sim 350^\circ$, olive-green U_3O_8 at 750° for 2 hr., and grey- or blue-black UO_2 at 1000° in dry H_2 . UO_3 gives no definite X-ray diffraction pattern. Qual. solubilities of (I) in acids and salt solutions are recorded. L. S. T.

Active substances. XLVII. Transformation and reaction processes during the heating of γ -iron hydroxide, cadmium carbonate, and stoichiometric mixtures thereof. II. W. Schröder (*Z. Elektrochem.*, 1941, **47**, 196—207).—An emanation method has been used to investigate the thermal behaviour of $\gamma\text{-Fe}(\text{OH})_3$, basic Cd carbonate, and spinel-forming mixtures thereof. The parts played by $\text{Fe}(\text{OH})_3$ and CdCO_3 in spinel formation are discussed with reference to these and other data. C. R. H.

Activation of passive iron in nitric acid. K. F. Bonhoeffer [with H. Beinert] (*Z. Elektrochem.*, 1941, **47**, 147—150).—Fe, rendered passive by HNO_3 , can be reactivated by a current of 10^{-4} coulomb per sq. cm., this current being approx. the same as that necessary for the reduction of a unimol. layer of Fe oxide. In HNO_3 -free

HNO_3 the potential of passive Fe drops from ~ 1 to ~ 0.5 v. during the passage of 2×10^{-5} coulomb, corresponding with a polarisation capacity of $\sim 40 \mu\text{F}$. per sq. cm. When the current is stopped the Fe returns to its passive state unless a limiting potential has already been attained, in which case the potential drops still further to 0.3 v. Passivity is due to an oxide layer with a higher dissociation pressure of O_2 than Fe_2O_3 . C. R. H.

Decomposition of the ammonia complex of tervalent cobalt. L. M. Orlova (*Zavod. Lab.*, 1939, **8**, 502).— $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ is reduced to CoCl_2 by boiling with $\text{Na}_2\text{S}_2\text{O}_3$ and HCl . J. J. B.

X.—ANALYSIS.

Determination of the precision of analytical control methods. R. F. Moran (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 361—364).—The use of statistical methods based on the standard deviation is described. The analytical method is first tested under the best obtainable conditions to find the highest precision of which the method is capable. Procedure necessary for this is specified. The method is then tested in routine practice for 1 year to determine the variability under routine laboratory conditions. A limit of uncertainty within which routine analyses can be guaranteed is then calc. Normal control methods have 1.5—2.5 times as much variation under routine conditions as the same method under the best conditions. Duplicate determinations made at the same time are generally not truly random, and the averaging of such results does not appreciably improve precision. Duplicate determinations are only a safeguard against mistakes such as an error in calculation or weighing. The above methods are exemplified by data for ρ of CCl_4 , and other representative commercial analytical methods. L. S. T.

Automatic electrochemical determination of concentration. F. Lieneweg (*Z. Elektrochem.*, 1941, **47**, 130—135).—Methods of determining ionic concns. by means of conductivity, electrode potential, c.d., and depolarisation measurements are discussed. C. R. H.

Chemical war-materials. H. Mohler (*Helv. Chim. Acta*, 1943, **26**, 769—770).—A reply to Epprecht (A., 1943, I, 161). F. J. G.

Dilution process for determining hydrogen-ion concentration with one-colour indicators. J. McCrae (*Analyst*, 1943, **68**, 183).—Equal quantities of indicator are added to the test solution and to the test solution made alkaline with NaOH so that its pH is above the range of the indicator. The second solution (I) is then diluted until there is a colour match between the two solutions. The relation, $\text{pH} = \text{pK} - \log(D - 1)$, where D is the ratio of final vol. to initial vol. of (I) and pK is the pH at the half transformation point of the indicator, holds for one-colour nitrophenol indicators. Calibration tables for the polyacidic one-colour indicators, phenolphthalein and salicyl-yellow, are given. S. B.

Behaviour of the quinhydrone electrode in plant liquids. Y. Kauko and L. Knappenberg (*Angew. Chem.*, 1940, **53**, 187—188).—Additional data for various plant juices show that pH vals. obtained using this type of electrode are untrustworthy. Whilst pH vals. obtained with a glass electrode remain const., those given by the quinhydrone electrode show variations with time. The use of a glass electrode for measuring the pH of plant juices is recommended. L. S. T.

Colorimetric determination of hydrogen peroxide. G. M. Eisenberg (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 327—328).—The method is based on photo-electric measurement of the colour intensities of H_2O_2 solutions treated with $\text{Ti}(\text{SO}_4)_2$ in dil. H_2SO_4 . Beer's law holds at 380—430 μ . The use of a 12.5-mm. cell increases the effective range of the method, and permits the determination of 0.2—3.0 mg. of H_2O_2 per 100 ml. of solution with an average deviation of ± 0.03 mg. L. S. T.

Determination of chloride in bauxite-supported anhydrous aluminium chloride catalysts. W. A. La Lande, jun., H. Heinemann, and W. S. W. McCarter (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 385—387).—Distillation of the sample with 18N- H_2SO_4 and determination of the liberated HCl by Volhard's method gives reproducible results representing 92—96% of the total chloride present. Extraction of the catalyst with H_2O by a standard procedure gives reproducible, but low (90—93%), results. Either method is satisfactory as a routine procedure. The total Cl^- content can be determined accurately by combining the two methods, the distillation method being applied to the powdered residue from the H_2O extraction. Details of procedure and typical data are given. L. S. T.

Turbidimetric determination of small amounts of chlorides. E. N. Luce, E. C. Denice, and F. E. Akerlund (*Ind. Eng. Chem. [Anal.]*, 1943, **15**, 365—366).—The nephelometric method is adapted to the Hellige turbidimeter in order to eliminate the disadvantages of reference standards. The method is suitable for 0—5 p.p.m. of Cl^- , and its accuracy is comparable with that of the nephelometer. A determination takes 15 min. of working time. L. S. T.

Determination of chloride in presence of hydrosulphide or sulphide ion. M. M. Maglio and F. Fazio (*Ind. Eng. Chem. [Anal.]*, 1943, **15**,

265—266).—HS' or S'' is pptd. as CuS by adding 5% aq. $\text{Cu}(\text{NO}_3)_2$ to the solution at pH 4 (HNO_3). Cl' is determined gravimetrically as AgCl in the filtrate. For samples ranging from 94 to 99% NaCl (6—1% $\text{NaSH}\cdot 2\text{H}_2\text{O}$) the average error is -0.08% , and the largest error, -0.19% .
L. S. T.

Automatic determination of oxygen. I. N. Kuzminich and E. I. Surkov (*Zavod. Lab.*, 1939, 8, 541—544).—In a standard Orsat tube a $\text{Na}_2\text{S}_2\text{O}_4$ solution cannot be substituted for the pyrogallol (I) solution as the former is too fluid; if, instead, the vessel is filled with glass tubes 1.5 cm. long a solution of $\text{Na}_2\text{S}_2\text{O}_4$ 14, NaOH 6.7, and H_2O 79.3% absorbs O_2 better than does (I).
J. J. B.

Substitution of calcium hydroxide for cadmium and zinc acetates in the determination of sulphur by Schulte's method. P. I. Schportenkeno and V. F. Garan (*Zavod. Lab.*, 1939, 8, 504—505).— H_2S is absorbed in a saturated $\text{Ca}(\text{OH})_2$ solution.
J. J. B.

Determination of hydrogen sulphide by titration with potassium dichromate. M. P. Babkin (*Zavod. Lab.*, 1939, 8, 108—109).—A solution containing 10 ml. of 3% HCl, 5 ml. of 10% KI, 25 ml. of H_2S solution, and a few drops of a starch solution is titrated with 0.1N- $\text{K}_2\text{Cr}_2\text{O}_7$ to a blue colour.
J. J. B.

Separation of carbon dioxide from volatile sulphur oxides. J. Jány and I. Fenyő (*J. Amer. Leather Chem. Assoc.*, 1943, 38, 215—218).—Sulphites are oxidised with boiling H_2O_2 in an atm. of H_2 . HCl is added and the CO_2 liberated is absorbed in soda-lime tubes. The SO_3'' is determined as BaSO_4 and the CO_3'' by the increase in wt. of the soda-lime tubes.
D. P.

Determination of impurities in air and the importance of chemical analysis in meteorology and climatology. E. Quitmann (*Angew. Chem.*, 1940, 53, 80—82).—Systematic examinations of air are limited to determination of the NH_3 , NO_2' , Cl', SO_4'' , and I'. The I is collected in aq. KOH whilst the other constituents are collected by condensing the H_2O vapour on a spherical surface cooled internally with solid CO_2 or by evaporation of EtOH, the frost then being melted and the H_2O analysed; the results are converted into μg . per cu. m. of air by measuring the R.H. and temp. of the air. Correlation of the results obtained by simultaneous analysis of the air at various altitudes and of any rain, snow, dew, or frost over a wide area affords valuable information for the meteorologist.
A. R. P.

Determination of nitrogen in mixed fertilisers.—See B., 1943, III, 166.

Colorimetric determination of phosphorus by reduction of phosphomolybdate to molybdenum-blue. P. J. Hardwick (*Analyst*, 1943, 68, 183—184).—Addition of 0.1% KClO_3 to phosphate solutions before reduction by SnCl_2 to Mo-blue prevented any development of green colour over a period of several hr.
S. B.

Micro-analysis of boracite. C. O. Harvey (*Analyst*, 1943, 68, 211—212).—0.1 g. of mineral suspected to be boracite ($6\text{MgO}\cdot\text{MgCl}_2\cdot 8\text{B}_2\text{O}_3$) was analysed, with duplicate determinations, each on 0.01 g. After fusion with $\text{Na}_2\text{CO}_3 + \text{K}_2\text{CO}_3$, the solution obtained was made neutral to Me-orange and titrated (for B) against 0.02N-NaOH in presence of mannitol, while aerating with CO_2 -free air, using phenolphthalein as indicator. Mg was pptd. as phosphate after Na_2CO_3 fusion and removal of B by evaporations with MeOH. Cl was pptd. as AgCl after fusion with mixed carbonates. Results showed Mg : B : Cl = 7.1 : 16 : 2.2; SiO_2 0.5%, $\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$ 2.3%, CaO 0.2%, MnO trace.
S. A. M.

Determination of silicic acid in presence of fluorides. A. A. Vassiliev and L. L. Laptshinskaja (*Zavod. Lab.*, 1939, 8, 27—31).—1 g. of fluoride containing <0.05 g. of SiO_2 is fused with H_3BO_3 , strongly ignited for 50 min., dissolved in 15 ml. of conc. $\text{H}_2\text{SO}_4 + 20$ ml. of H_2O , heated to SO_3 fumes, diluted with H_2O , and heated again. The rapid method of Tananaev and Babko (cf. B., 1930, 1110) is also recommended.
J. J. B.

Rapid determination of silicon and phosphorus in cast iron.—See B., 1943, I, 338.

Determination of silicates and silicides in steel.—See B., 1943, I, 339.

Direct determination of combined carbon in cast iron and steel.—See B., 1943, I, 338.

Photometric determination of potassium by a modified Jacobs-Hoffman method. A. Eden (*Analyst*, 1943, 68, 167—170; cf. A., 1932, 102).—For the determination of about 0.1 mg. of K (0.02 mg. per ml.) in blood sera, solutions of ashed tissues, and inorg. solutions free from NH_4' , slightly modified conditions of pptn. and washing are given.
S. B.

Determination of potash in fertilisers.—See B., 1943, III, 166.

Colorimetric determination of sodium. E. A. Arnold and A. R. Pray (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 294—296).—The triple UO_2 acetate (Zn or Mg) is treated with excess of $(\text{NH}_4)_2\text{CO}_3$ and H_2O_2 and the [U] determined colorimetrically using a wave band of 5200 Å.
L. S. T.

Determination of sodium by the uranyl method. V. S. Krasnova (*Zavod. Lab.*, 1939, 8, 219).—When Na' and SO_4'' are present together, the ppt. consisting of $\text{NaZn}(\text{UO}_2)_3(\text{OAc})_6\cdot 6\text{H}_2\text{O}$ (I) and insol. sulphates is weighed, washed out with cold H_2O to colour change, and weighed again; the loss of wt. is the amount of (I) present.
J. J. B.

Determination of free alkali in potassium chromate. L. E. Sabinina and A. A. Babalova (*Zavod. Lab.*, 1939, 8, 413—416).—Solutions of pure K_2CrO_4 have pH ~ 9.8 . The alkali in less pure samples can be determined by acidifying the solution and titrating it, using a PbO_2 or a glass electrode.
J. J. B.

Use of an iodine derivative of methylene-blue in qualitative analysis. L. M. Kulberg (*Zavod. Lab.*, 1939, 8, 421—423).—Methylene-blue (I) forms with KI_3 in H_2O a brownish-black insol. compound, probably a polyiodide. It liberates (I) in presence of Ag' , Hg' , Hg'' , S'' , SO_3'' , $\text{S}_2\text{O}_3''$, and Sn'' . 2×10^{-10} g. of Ag or 2×10^{-8} g. of Hg can be thus detected.
J. J. B.

Micro-determination of magnesium with the polarograph. C. Carruthers (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 412—414).—8-Hydroxyquinoline (I) is reduced at the dropping Hg electrode, and the diffusion current is \propto concn. Mg'' is pptd. as the salt with (I) and then determined polarographically in PO_4''' buffer-HCl-gelatin mixture at 25° . Polarograms, typical data, and procedure for determining Mg in tissues are given.
L. S. T.

Microchemical determination of magnesium. P. Vukulov (*Zavod. Lab.*, 1939, 8, 494—495).—Mg is pptd. as $\text{Mg}(\text{OH})_2$ and the latter titrated with 0.1N-HCl.
J. J. B.

Determining magnesium in plants.—See A., 1943, III, 704.

Determination of magnesium in aluminium alloys.—See B., 1943, I, 341.

Polarographic analysis of lead and its compounds. S. P. Schaikind (*Zavod. Lab.*, 1939, 8, 567—571).—Cu, Cd, Ni, Zn, and Mn can be determined polarographically in Pb solutions.
J. J. B.

Determination of copper and zinc in fertilisers.—See B., 1943, III, 166.

Determination of mercury in air with dithizone. N. S. Kuziatina (*Zavod. Lab.*, 1939, 8, 174—177).—Air containing Hg is passed through 0.05N- KMnO_4 in 5% H_2SO_4 , and the solution is made colourless with $\text{H}_2\text{C}_2\text{O}_4$ and shaken with a solution of diphenylthiocarbazone in CHCl_3 . To a control mixture as much HgSO_4 is added as produces an identical coloration.
J. J. B.

[Reineckate-thiocarbamide complexes in] colorimetric analysis. C. Mahr (*Angew. Chem.*, 1940, 53, 257—258).—Hg, Cd, or Cu is separated from other metals in the usual way and then converted into the reineckate (I). The washed moist (I) is dissolved in COMeEt containing 2% of $\text{CS}(\text{NH}_2)_2$ (II), and the sol. (I)-(II) complex determined colorimetrically. The method is particularly suitable for determination of Cd in excess of Zn, and of Cu in steel.
M. H. M. A.

Determination of aluminium as cryolite. I. V. Tananaev and S. Talipov (*Zavod. Lab.*, 1939, 8, 23—27).—Al can be pptd. and weighed as Na_3AlF_6 if the Al solution is added to $\sim 3\%$ aq. NaF, the mol. ratio NaF : AlCl_3 being > 9 . If the Al solution contains Be, the NaF solution must be $\sim 1\%$. If NaF is added to AlCl_3 , the results are too low.
J. J. B.

Detection of aluminium. V. A. Zacharievski (*Zavod. Lab.*, 1939, 8, 33—36).— Al''' gives a red coloration with a reagent made up of 0.04 g. of $\text{ZrO}(\text{NO}_3)_2\cdot 4\text{H}_2\text{O}$ in 10 ml. of H_2O , 0.02 g. of alizarin-red in 5 ml. of EtOH, 0.0006 mol. of KF in 1 ml. of H_2O , and ~ 50 ml. of 2N-HCl. OCl' , $\text{C}_2\text{O}_4''$, and SO_4'' , as well as more F' , interfere.
J. J. B.

Determination of sesquioxides in the form of phosphates. A. G. Filippova (*Zavod. Lab.*, 1939, 8, 98—101).—For combined determination of $\text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3$ in phosphorites the method of Charlot (A., 1937, I, 477) (slightly modified) is recommended. F' has first to be eliminated, but flotation reagents do not interfere.
J. J. B.

Colorimetric determination of small amounts of indium. T. Moeller (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 270—272).—The In compound of 8-hydroxyquinoline (I), $\text{In}(\text{C}_9\text{H}_6\text{ON})_3$, dissolves in CHCl_3 giving yellow solutions which show an absorption band at 395—400 μ . At 400 μ . such solutions obey Beer's law in concns. > 18.0 mg. of In per l. of CHCl_3 . In''' is completely extracted from aq. solution at pH 3.2—4.5 by shaking with (I) in CHCl_3 . Al''' , Sn'' , Bi''' , Fe'' , Fe''' , Co'' , Ni''' , Cu'' , Ti''' , and Ga''' are also extracted at pH 3.5, and thus interfere. In''' can be accurately determined in presence of Zn'' , Cd'' , and Pb'' , but not of Fe''' , by the method described. Results are accurate for 0.3—20 mg. of In per l. of CHCl_3 , or 0.015—1.00 mg. of In''' in 25 ml. of aq. solution.
L. S. T.

Ferrocyanidometric determination of iron. M. A. Bodin (*Zavod. Lab.*, 1939, 8, 32—33).—To 100 ml. of a solution containing > 3 mg. of Fe''' , ~ 10 g. of $(\text{NH}_4)_2\text{SO}_4$, and ~ 10 g. of H_2SO_4 , 5 ml. of

10% NH_4CNS is added, and the solution is shaken with 10 ml. of $\text{iso-C}_5\text{H}_{11}\text{OH}$ and titrated with 0.5% $\text{K}_4\text{Fe}(\text{CN})_6$ solution until the $\text{C}_5\text{H}_{11}\text{OH}$ becomes colourless. A control sample must be titrated using the same $[\text{H}_2\text{SO}_4]$. J. J. B.

Vanadometric volumetric micro-determination of iron. V. V. Stepin (*Zavod. Lab.*, 1939, 8, 262—264).— Fe^{+++} is reduced to Fe^{++} by SnCl_2 and then titrated with NH_4VO_3 in presence of phenylanthranilic acid. Procedures for determining Fe in limestone, a Mn ore, and ceramic materials are given. J. J. B.

Separation of rare metals by electrolysis with a mercury cathode. I. P. Alimarim and B. I. Frid (*Zavod. Lab.*, 1939, 8, 496).—Fe is electrodeposited from a solution of Fe^{+++} and various rare metals (Ce, La, Sm, Er, Pr, Nd) in 1% H_2SO_4 . J. J. B.

Determination of ferrous iron in vivianites. V. A. Kararinova-Oknina and N. A. Nikitina (*Zavod. Lab.*, 1939, 8, 498—499).—Vivianite is dissolved in HCl and titrated with I in presence of NH_4F and $\text{K}_2\text{C}_2\text{O}_4$. J. J. B.

Determination of iron in presence of chromium and titanium with the Jones reductor. F. S. Grimaldi, R. E. Stevens, and M. K. Carron (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 387—388).— H_2SO_4 solutions of $\text{Ti}_2(\text{SO}_4)_3$ and CrSO_4 solutions, obtained by passage through the Jones reductor, are oxidised by aeration for 5—10 min. in presence of CuSO_4 as catalyst. The Fe^{++} is essentially unoxidised, and is titrated by 0.05N- KMnO_4 (*o*-phenanthroline). 3 ml. of 0.0001M- CuSO_4 per 300 ml. of solution give the best results. Larger amounts of Cu^{++} lead to low results for Fe^{++} when both Ti and Cr are present. Details of procedure and typical data for the method, which is applicable to all Fe:Ti:Cr ratios, are given. Mo and V must be absent. Simple air-oxidation of Ti^{+++} is untrustworthy (cf. A., 1943, I, 24). L. S. T.

Extraction and colorimetric determination of certain metals as derivatives of 8-hydroxyquinoline. T. Moeller (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 346—349).—Spectrophotometric examination of CHCl_3 solutions of the following 8-hydroxyquinoline (I) complexes shows absorption max. at 470 and 570 $\text{m}\mu$. for Fe^{II} , 395 $\text{m}\mu$. for Al, Bi, and Ni, 420 $\text{m}\mu$. for Co, and 410 $\text{m}\mu$. for Cu. Agitation of aq. solutions containing these ions with (I) in CHCl_3 gives complete extraction in the following optimum ranges of pH: Fe 1.9—3.0, Al 4.3—4.6, Bi 4.0—5.2, Co 4.6—8, Ni 4.6—7, and Cu 2.7—7.0. CHCl_3 solutions containing the equiv. of ≥ 20 mg. of these metals per l. show little or no deviation from Beer's law at the $\lambda\lambda$ given, and hence are suitable for colorimetric determinations. Cu can be determined in presence of 40 times as much Cd or Zn by extraction at pH 4.0 and transmittancy measurement at 410 $\text{m}\mu$. pH vals. for hydrous oxide or hydroxide formation, pptn. as complex with (I), and extraction as this complex are correlated. L. S. T.

Determination of ferrous iron in difficultly-soluble materials.—See B., 1943, I, 328.

Colorimetric determination of cobalt with *o*-nitrosoresorcinol. L. G. Overholser and J. H. Yoe (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 310—313).—The red colour given by Co^{++} and *o*-nitrosoresorcinol (I) is used as the basis of a colorimetric method for determining Co^{++} . Spectrophotometric data for solutions of (I), for the Co complex, and for complexes with Cd, Zn, Ni, Cu, and Pd are recorded. For Co, Beer's law holds at 430 and 450 $\text{m}\mu$. Procedures for determining Co^{++} alone and in presence of Ni^{++} are given, and data showing the effect of pH on the colour of (I), and of the Co complex, are recorded. (I) is slightly less sensitive as a reagent for Co^{++} than is 2:1- $\text{NO}\cdot\text{C}_{10}\text{H}_6\text{OH}$, but the Co complex is stable for several weeks. The complex could not be extracted by an immiscible solvent. L. S. T.

Determination of small amounts of cobalt in presence of large amounts of iron. P. V. Faleev (*Zavod. Lab.*, 1939, 8, 381—383).—0.5—10 mg. of Co can be determined in presence of 0.4—4 g. of Fe by pptg. with 30% solution of KNO_2 in a solution containing 7—8% of free AcOH and leaving the ppt. overnight. J. J. B.

Applicability of the pressed-pellet electrode method to spectrographic analysis of nickel alloys.—See B., 1943, I, 341.

Determination of chromic oxide in presence of chromium trioxide. W. J. Agnew (*Analyst*, 1943, 68, 182).— Cr_2O_3 is pptd. as $\text{Cr}(\text{OH})_3$ from solutions just acid to litmus, filtered on asbestos, washed and redissolved in 1:3 H_2SO_4 (20 ml.), diluted to ~ 600 ml., and oxidised with KMnO_4 . The excess of KMnO_4 is removed by MnSO_4 at the b.p., the solution cooled, and CrO_3 determined by adding an excess of $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2$ and titrating with KMnO_4 . Small "blanks" due to $\text{Cr}_2(\text{CrO}_4)_3$ or adsorbed $\text{K}_2\text{Cr}_2\text{O}_7$ are determined on the solution of the $\text{Cr}(\text{OH})_3$ ppt. before oxidation. S. B.

Spot test for chromium in steels.—See B., 1943, I, 339.

Precipitation of uranium with hydrogen sulphide in presence of hexamethylenetetramine. E. A. Ostroumov and R. I. Bomshtein (*Zavod. Lab.*, 1939, 8, 558—561).— H_2S at 60° pptn. from a solution of UO_2Cl_2 and $(\text{CH}_2)_6\text{N}_4$ a "U-red," $(\text{NH}_4\text{O}\cdot\text{UO}_2\cdot\text{O})_4\text{U}(\text{OH})\cdot\text{S}\cdot\text{SNH}_4$ (I). (I) has X-ray spacings of 7.60, 3.74, 3.52, 3.19, 2.55, 2.04, 1.96, 1.70, and 1.65 Å. The pptn. of (I) is quant. and one pptn.

separates U from Ca, Mg, K, and Na. For analytical purposes (I) is heated, giving U_3O_8 . J. J. B.

Rapid determination of titanium in ferrotitanium.—See B., 1943, I, 339.

XI.—APPARATUS ETC.

Theory of the electric arc furnace. P. Drossbach (*Z. Elektrochem.*, 1940, 46, 643—646).—Mathematical. Equations for the extent of the melting zone and for the energy distribution in the electric arc furnace have been derived. C. R. H.

Experimental details for a precision high-temperature control utilising the Hull circuit. C. E. Waring and G. Robison (*Rev. Sci. Instr.*, 1943, 14, 143—146).—A method of temp. control applicable to electrically heated air-baths and furnaces which may be regulated to $\pm 0.05^\circ$ is described, the regulation being obtained by the oscillation of a galvanometer beam across a photo-cell which controls a thyatron circuit. The galvanometer is operated by a Pt-resistance thermometer-bridge circuit. J. L. E.

Obtaining helium temperatures without using specially liquefied hydrogen. K. Seiler (*Z. Elektrochem.*, 1941, 47, 116—119).—An apparatus which dispenses with the need for large quantities of liquid H_2 and requires only a small amount for precooling the He is described. C. R. H.

Plug-in thermocouple head. S. R. Jones (*J. Sci. Instr.*, 1943, 20, 116).—The arrangement described allows rapid replacement of a couple which fails or develops faults at a crit. stage of pyrometric measurements. N. M. B.

Ultra-violet photometer for analysis of solutions. I. M. Klotz (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 277—278).—Results obtained with PhOH , KNO_3 , and sulphanilamide are described. Min. changes in concn. detectable are 3×10^{-5} , 3×10^{-5} , and 2×10^{-6} g., respectively, per l. of H_2O . L. S. T.

Modification of Cenco spectrophotometer permitting measurements of reflexion and fluorescence spectra. H. J. Dutton and G. F. Bailey (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 275—277). L. S. T.

Colorimetry and spectrophotometry as analytical methods. G. Kortüm and J. Grambow (*Angew. Chem.*, 1940, 53, 183—187).—Calibration curves obtained for solutions of K_2CrO_4 , benzopurpurin, and naphthol-yellow with the Zeiss step-photometer and the Lange photo-electric spectrophotometer at different lamp voltages show the extent of the error introduced by the non-monochromatic nature of the light used. These errors are eliminated by using a two-step immersion colorimeter. L. S. T.

Two-colour prism or screen for observing colorimetric test-tubes. V. F. Petrov (*Zavod. Lab.*, 1939, 8, 337).—A device for improving illumination is described. J. J. B.

Step weakener for spectrochemical analysis in the ultra-violet. N. S. Sventitzki (*Zavod. Lab.*, 1939, 8, 512—514).—The intensity of ultra-violet light is reduced by passing it through a layer of soot deposited on a quartz plate. J. J. B.

Determination of optical constants of metals by reflectivity measurements. J. R. Collins and R. O. Bock (*Rev. Sci. Instr.*, 1943, 14, 135—141).—The reflectivity of linearly polarised light at various angles of incidence on plane evaporated samples of pure metals is measured throughout the spectral range from 4800 to 24,000 Å. By use of the electromagnetic equations describing the reflexion process a graphical method for obtaining the optical consts. from the data is worked out. J. L. E.

Simple method of demonstrating diffraction grating effects. (Sir) L. Bragg and H. Lipson (*J. Sci. Instr.*, 1943, 20, 110—111).—The apparatus described allows Fraunhofer diffraction at very small angles to be observed, and provides a simple way of demonstrating diffraction by comparatively large objects; the orders of diffraction from gratings of ~ 1 mm. spacing are well separated. Effects produced by deliberate ruling errors simulate observed X-ray diffraction effects. Several gratings are described and diffraction patterns are discussed with reference to X-ray diffraction effects from transition structures in alloys (Cu_4FeNi_3 and AuCu_3). N. M. B.

Simple and permanent Tyndall cone apparatus. H. J. Abrahams and A. Dubner (*J. Chem. Educ.*, 1943, 20, 61—62). L. S. T.

Mirror used to show spot plate tests. G. P. Percival (*J. Chem. Educ.*, 1943, 20, 87).—Colours produced in drop reactions are reflected to an audience by a mirror suspended at an angle above the plate. L. S. T.

Simple photo-electric absorptiometer.—See B., 1943, I, 310.

Preparation of manganese filters for absorption of the $K\beta$ radiation of X-ray tubes with an iron anode. E. N. Kisliakova and M. F. Medvedev (*Zavod. Lab.*, 1939, 8, 114—115).—Prep. of filters from Mn_2O_3 and shellac is described. J. J. B.

Apparatus for detecting luminescent ores. G. F. Komovski (*Zavod. Lab.*, 1939, 8, 514—516).—Ores are illuminated by a spark from a hand-operated magneto; scheelite, e.g., can be found in this way. For irradiation with cathode rays a portable hand pump giving a vac. of 5×10^{-3} mm. Hg is used. J. J. B.

Determination of X-ray amorphous substances in presence of crystalline materials. R. Fricke (*Z. Elektrochem.*, 1940, 46, 641—642).—Small points of experimental technique are discussed. C. R. H.

Apparatus for rapid X-ray structure tests and X-ray motion pictures. L. V. Altschuler and V. A. Zukerman (*Zavod. Lab.*, 1939, 8, 449—458). J. J. B.

X-Ray tube for analysis of fluorescence spectra. A. I. Krasnikov (*Zavod. Lab.*, 1939, 8, 458—461). J. J. B.

Stabilisation of the alternating current arc used for quantitative spectrochemical analysis. N. S. Sventitzki (*Zavod. Lab.*, 1939, 8, 470—471).—The arc is permanently illuminated by a small spark; the photo-electric effect thus produced prevents extinguishing of the arc. J. J. B.

Micro-electrodes for measuring local oxygen tension in animal tissues.—See A., 1943, III, 704.

Electrographic methods of surface analysis [of metals].—See B., 1943, I, 343.

Application of the electrode couple platinum and graphite for potentiometric titration in neutralisation and oxidation-reduction reactions. A. S. Tichonov (*Zavod. Lab.*, 1939, 8, 17—19).—The pair Pt-pencil core can be used for oxidation and reduction titrations but not for neutralisation. J. J. B.

Dual alternating current titrometer. C. J. Penther and F. B. Rolison (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 337—340). L. S. T.

Device for determining the kinetics of dissolution of metals. A. F. Maltzev (*Zavod. Lab.*, 1939, 8, 73—76).—An apparatus is constructed which permits a simultaneous measurement of the potential of dissolving metal and of the rate r of gas evolution. For Mg in HCl r is const. for a const. [HCl] which was varied between 5×10^{-4} and 5×10^{-5} N. J. J. B.

Experimental mass spectrometer. N. D. Coggeshall and E. B. Jordan (*Rev. Sci. Instr.*, 1943, 14, 125—129).—An all-metal, sector-shaped magnetic field type mass spectrometer is so designed that it may be disassembled, repaired, or modified without altering its focussing properties, and having a removable ion source unit. The instrument was designed for investigating different source arrangements. J. L. E.

Rapid γ -ray inspection technique.—See B., 1943, II, 268.

Effect of ray potential on the electron-microscope image. B. von Borries and E. Ruska (*Z. Physik*, 1940, 116, 249—256).—With bright field images, increasing ray potential gives greater transmission through the object, and with thicker objects, brings out finer details. With dark-field images, the thickness for max. brightness is greater for higher than for lower potentials. A. J. M.

Sub-optical microscopic resolution of the images of surfaces in the electron microscope. B. von Borries (*Z. Physik*, 1940, 116, 370—378).—If a metallic surface is placed at a small angle with the objective axis of an electron microscope, and irradiated with electrons at a small angle, a magnification of 14,000 can be obtained. It is possible to obtain a direct resolution of 50 μ , so that the resolving power of the electron microscope when used to investigate surfaces in this manner exceeds that of optical microscopy. Etched specimens of different types of Fe show characteristic differences in the images. Surface microscopy can also be used for the control of the planeness of surfaces. Foreign bodies in smooth surfaces can also be detected and measured. A. J. M.

Representation of electron-irradiated surfaces. E. Ruska and H. O. Müller (*Z. Physik*, 1940, 116, 366—369).—Apparatus is described for the production of an image of a surface irradiated with electrons, by means of the electron microscope, instead of the electrons passing through the object. The process is of special use in metallography, is applicable at all temp., and requires no special prep. of the surface. A. J. M.

Reproducibility of weighings made on microchemical balances. (A.C.S. Committee Report). C. J. Rodden, J. A. Kuck, A. A. Benedetti-Pichler, A. Corwin, and E. W. D. Huffman (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 415—416; cf. A., 1941, I, 224).—The test consisted in weighing 1-g. wts. one against the other, each weighing being followed by a rest-point determination, and the rider being reset for each weighing and each rest-point. 29 micro-balances of 4 different makes were used. The standard deviation of individual weighings (median val.) is $\pm 3.4 \mu$ g., the probable error of individual weighings $\pm 2.3 \mu$ g., and the largest error to be expected in any one weighing $\pm 7 \mu$ g. 7-mg. samples should be taken for an analysis when an accuracy of 0.1% is desired for sample wts. L. S. T.

Gas balance. V. G. Fastovski and I. G. Gurvitsch (*Zavod. Lab.*, 1939, 8, 77—82).—The density balance of Stock and Ritter (A., 1926, 669) is improved and used for the quant. analysis of gas mixtures. The range of usefulness of a particular balance is enlarged by incorporating a magnet into the balance beam; this makes it possible to shift the zero point of the balance by means of a magnet. J. J. B.

Improved micrometer burette. P. F. Scholander, G. A. Edwards, and L. Irving (*J. Biol. Chem.*, 1943, 148, 495—500).—The burette (cf. A., 1942, I, 250) has interchangeable parts for titration and for the calibration of other instruments. It delivers the total capacity with an accuracy of 1 part in 6000—7000 and is easier to clean and to assemble than the original apparatus. J. E. P.

Method of viscosity measurement in the region of 10^8 poises. S. M. Cox (*J. Sci. Instr.*, 1943, 20, 113—114).—A simple method by spherical imprint is especially suited for glasses in their softening range. The formula for η in terms of radius of imprint a , compressive force P , time t , and radius of sphere R is shown by analogy with elastic displacement to be $\eta = 9PRt/16a^3$. N. M. B.

Apparatus for purification of hydrocarbons by recrystallisation.—See A., 1943, II, 286.

Protractor for a direct measurement on a screen of contact angles. M. E. Lipetz (*Zavod. Lab.*, 1939, 8, 336—337). J. J. B.

Universal apparatus for gas evolution. V. M. Galak (*Zavod. Lab.*, 1939, 8, 502—504).—An improved Kipp apparatus is described. J. J. B.

Liquid absorber for hydrogen. G. J. Veinberg (*Zavod. Lab.*, 1939, 8, 549—552).—Na anthraquinonedisulphonate (cf. Bonney and Huff, A., 1937, I, 323) is the best absorber; stabilised Pd sols or PdCl₂ activated with Co are almost as good. J. J. B.

Filtration cylinder. R. J. DeGray and E. P. Rittershausen (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 392).—The crucible and its adapter are fitted into a rubber bung which rests on the top of a heavy glass cylinder, fitted with a side-arm, and large enough to enclose a 100-ml. volumetric flask or a 4-oz. bottle. L. S. T.

Sintered glassware. I. C. P. Smith (*Ind. Chem.*, 1943, 19, 317—321, 393—398).—Filter crucibles, Büchner funnels, pressure filters, centrifuge filters, micro-chemical apparatus, extractors, supports for fillings, and apparatus for gas manipulation are described. Graphs relating rate of air flow and pressure for various porosities are reproduced. J. G.

Simplification of glass cleaning with chromic-sulphuric acid. C. Tropp and F. Geiger (*Biochem. Z.*, 1940, 304, 81—83).—An apparatus for storage of the cleaning mixture and for transferring it to dirty apparatus is described. J. N. A.

Molecular still designed for small charges [0.25—5 g. of oil]. J. R. Matchett and J. Levine (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 296). L. S. T.

Low-pressure gauge. F. E. E. Germann and K. A. Gagos (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 285—286).—A gauge of the floating barometer type is described. With Hg as confining liquid the range is 10^{-2} to 10^3 mm. of Hg, and with Apiezon B oil the lower range is extended to 6.4×10^{-4} mm. L. S. T.

Mercury-balance pressure regulator. A. J. Bailey (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 283—284). L. S. T.

Forceps with platinum-covered tips. E. W. Balis and H. A. Liebafsky (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 350).—An improved method for covering the tips of forceps with Pt foil is described. L. S. T.

Apparatus for preparing an average sample. P. I. Boshenov (*Zavod. Lab.*, 1939, 8, 211—213).—The powder to be tested is passed through a funnel which separates a representative sample. J. J. B.

Low-holdup laboratory [macro- and semi-micro-fractionating] columns. J. R. Bower, jun., and L. M. Cooke (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 290—293). L. S. T.

Large-scale laboratory extractor of the Soxhlet type. K. E. Rapp, C. W. Woodmansee, and J. S. McHargue (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 351). L. S. T.

Mixed solvent extraction. J. H. Wiegand (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 380—383).—The methods of analytical geometry are applied to the computation of mixed solvent extraction problems involving four components. L. S. T.

Improved meter for the measurement of gas flow rates. W. G. Appleby and W. H. Avery (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 349—350). L. S. T.

Measurement of the rate of outflow of liquids. M. Kaliko (*Zavod. Lab.*, 1939, 8, 599—600).—A kind of Pitot tube is used. J. J. B.

Theory of calibration of rheometers. M. I. Temkin (*Zavod. Lab.*, 1939, 8, 597—599).—Equations are given for calculating the rate of flow of a gas if that of another gas through the same flow meter is known. J. J. B.

Flow manostat for various purposes, including candy test. M. J. Proffitt (*J. Res. Nat. Bur. Stand.*, 1942, 29, 143—155).—The manostat described has a floating orifice modulator and const. discharge nozzles, whereby the flow of a gas from a source of moderately variable pressure is regulated.
L. J. J.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Representation of periodic properties of the elements. T. H. Hazlehurst and F. J. Fornoff (*J. Chem. Educ.*, 1943, 20, 77—79).
L. S. T.

The first chemical reagent. M. Nierenstein (*Analyst*, 1943, 68, 212—213).—Pliny's reagent for the detection of Fe in verdigris by papyrus soaked in a solution of gall nuts (60 A.D.) is compared with later modifications.
S. A. M.

XIII.—GEOCHEMISTRY.

Distribution of helium and radioactivity in rocks. V. Rocks and associated minerals from Quebec, Ontario, Manitoba, New Jersey, New England, New Brunswick, Newfoundland, Tanganyika, Finland, and Russia. N. B. Keevil (*Amer. J. Sci.*, 1943, 241, 277—306).—Radioactive contents and He indexes of >25 rocks and associated minerals are reported and discussed. Variations in He indexes are due generally to loss of radiogenic He and occasionally to the presence of extraneous He. Distribution of radioactivity in rocks is not uniform; the mafic minerals are usually three times as active as the felsic constituents of a rock. Conc'n. of the radioactivity of a rock in the accessory minerals often occurs. The difference in activity between mafic and felsic constituents tends to be the greater the higher is the activity of the rock as a whole. He ages are not completely trustworthy, but He indexes are useful guides when more exact information is not available. Felsic samples, porphyries, and altered rocks give the least trustworthy indications of age. Ages for various rocks are discussed in the light of the data obtained.
L. S. T.

Causes of variations in radioactivity data [for rocks]. N. B. Keevil, A. R. Keevil, W. N. Ingham, and G. P. Crombie (*Amer. J. Sci.*, 1943, 241, 345—365).—Data recorded for rocks show variations by a factor of ≤ 50 in the radioactive content from specimen to specimen. The greatest differences occur in certain granitic rocks, the least in sedimentary sections. Regional variations are not pronounced, but relatively high radioactive provinces are indicated in Colorado and Great Slave—Great Bear Lakes areas, and relatively barren areas in parts of Ontario and Quebec. Variation in sp. radioactivity of a rock can be due to inadequate sampling of the specimen, irregular localisation of radioactive elements in crystals of accessory minerals, and the effects of differentiation in the distribution of radioactive minerals within the intruded mass. Further evidence of the conc'n. of radioactivity in zircon and apatite is available. In the Bourlamaque batholith radioactivity is conc. near the borders of the intrusive.
L. S. T.

Radioactive aureoles around some ore deposits. N. B. Keevil (*Amer. Min.*, 1942, 27, 225).
L. S. T.

Autoradiography of ores. C. Goodman and G. A. Thompson (*Amer. Min.*, 1942, 27, 223; cf. A., 1942, I, 115).—Autoradiographic studies of Mn-, Au-, Cd-, and P-bearing ores have been made using stray, slow neutrons from a cyclotron on elements having large nuclear cross-sections for (η , γ) reactions and yielding radioactive isotopes of convenient half-periods. The locus and relative concns. of these elements in the constituent minerals are determined by placing polished sections of the activated ores in contact with photographic film. The source of the effective β -radiation is determined from the decay rate and intensity of the activity.
L. S. T.

Specific gravity relationships of australites. G. Baker and H. C. Forster (*Amer. J. Sci.*, 1943, 241, 377—406).—A statistical examination of the sp. gr. vals. of >1000 specimens of australites shows that they are distributed according to chemical composition, and indicates that there is > one fraternity of australites within each of the shape groups (buttons, lenses, ovals, etc.) from each locality. There is no significant relationship between wts. and sp. gr. Fusion experiments show that volatilisation of greater quantities of heavier than of lighter components from australite glass results in a decrease of sp. gr.
L. S. T.

Miarolitic pegmatites in monzonite, Beaver Creek stock, Bearpaw mountains, Montana. W. T. Pecora and B. Fisher (*Amer. Min.*, 1942, 27, 229).
L. S. T.

Paragenesis of the McDonald pegmatite near Hybla, Ontario. K. K. Landes (*Amer. Min.*, 1942, 27, 226).
L. S. T.

Gold mineralisation in minor igneous intrusions. W. W. Moorhouse (*Amer. Min.*, 1942, 27, 227).—Evidence that replacement and intrusion by albitic material were accompanied by the Au-pyrite mineralisation is discussed.
L. S. T.

Geology of the nickel silicate deposit near Riddle, Oregon. W. T. Pecora and S. W. Hobbs (*Econ. Geol.*, 1941, 36, 841).—On Nickel Mountain, an irregularly distributed blanket of weathered rock contains discontinuous boxwork veinlets of quartz and garnierite (I). The deposits richest in Ni are underlain by unserpentinised peridotite. (I) contains 2—36% of Ni, and is a Ni-rich deweylite (II). The Ni and Mg were probably derived from weathering of olivine in the unserpentinised peridotite. Under present climatic conditions, (II) [Ni-poor (I)] is chemically attacked by surface waters causing Ni enrichment of (II) *in situ* to form (I), pptn. of SiO_2 to form quartz, and supergene deposition of (I) itself in open fractures.
L. S. T.

Nickel deposit near Dracut, Massachusetts. W. H. Dennen (*Econ. Geol.*, 1943, 38, 25—55).—A small pyrrhotite (I)—pentlandite—chalcopyrite deposit between Lawrence and Lowell, Massachusetts, occurs in a Paleozoic noritic stock in Cambrian quartzite. The deposit has been worked for Au, Ag, Fe, Cu, and Ni. Spectrographic analysis of (I) shows the presence of 1.5% Ni and 0.62% Co. The ore minerals, formed subsequently to the crystallisation of the silicates, show unusual mineragraphic characteristics which are described.
L. S. T.

Scheelite-powellite minerals of the Seven Devils district, Idaho. R. S. Cannon, jun., and F. S. Grimaldi (*Econ. Geol.*, 1941, 36, 839—840).—Minerals having the physical appearance of scheelite occur in most of the pyrometasomatic Cu deposits. Chemical analyses show that these minerals are not pure CaWO_4 , but are members of the isomorphous series scheelite-powellite.
L. S. T.

"Opalite" type of quicksilver deposit. R. G. Yates and R. J. Roberts (*Econ. Geol.*, 1941, 36, 839).—The opalite is composed mainly of chalcedony (I) with minor amounts of quartz and opal. Cinnabar (II), intimately mixed with SiO_2 , occurs in fractures, cavities, etc., and is disseminated also in the massive rock. Deposits were formed probably at shallow depths. Existing rock was first replaced by opal, which either dehydrated to or was replaced by (I). (II) was deposited from siliceous H_2O after the major silicification was over.
L. S. T.

Some concepts on the geology of quicksilver deposits in the United States. J. Pollock (*Econ. Geol.*, 1943, 38, 149—153; cf. A., 1943, I, 171).
L. S. T.

Mineralogy of Pinchi lake. A. C. Freeze (*Amer. Min.*, 1942, 27, 221—222).—Glaucophane (I) is widespread, and is present in rocks of both sedimentary and igneous origin. An introduction of Na_2O is necessary to account for the distribution and amount of (I). The cinnabar mineralisation and the accompanying mineral suite are much younger than the (I) and related minerals.
L. S. T.

Bismuth-ochre, bismutite, bismutosphaerite, basobismutite, bismite, and bismoclite. C. Frondel (*Amer. Min.*, 1942, 27, 222).—41 specimens of bismutite (I), Bi-ochre, and bismutosphaerite (II) from 34 localities have been examined by X-ray, optical, and chemical methods. (I), supposedly a hydrated Bi carbonate, contained only non-essential H_2O , and is identical with (II), Bi_2CO_5 . Basobismutite also is identical with Bi_2CO_5 . So-called Bi-ochres proved to be Bi_2CO_5 , Bi arsenate, cerussite, etc. Artificially-prepared hydrous Bi carbonate and (I) give a smooth dehydration curve to $\sim 290^\circ$, when the CO_2 is lost and $\alpha\text{-Bi}_2\text{O}_3$ remains. Definite hydrates could not be synthesised. The identity of bismite (III), supposedly Bi_2O_3 , is uncertain; 22 specimens labelled (III) from 15 localities showed neither $\text{Bi}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$, nor any of the 4 polymorphs of Bi_2O_3 ; 8 were Bi_2CO_5 , 2 were bismoclite (IV), and 4, a rare carbonate of Bi and Ca. (IV), BiOCl , hitherto known only from S. Africa, is described from Bygoo, N.S.W., and Tintic, Utah. (III) reported from Goldfield, Nevada, is also (IV). Reported syntheses of $\text{Bi}_2\text{O}_3 \cdot \text{H}_2\text{O}$ and other hydrates could not be confirmed; most are $\alpha\text{-Bi}_2\text{O}_3 \cdot n\text{H}_2\text{O}$.
L. S. T.

Settling of heavy minerals in a granodiorite dyke at Bradford, Rhode Island. A. Quinn (*Amer. Min.*, 1943, 28, 272—281).—The proportion of heavy minerals increases systematically towards the base of the dyke. This is probably due to crystal settling which occurred when the low- η magma moved upwards along the dyke.
L. S. T.

Crystallography of hureaulite. J. Murdoch (*Amer. Min.*, 1943, 28, 19).—Hureaulite, hardness 3—4, formed close to the end of a sequence of phosphate minerals at Pala, California, shows good crystals with $a:b:c = 1.9037[?]:1:1.0470$, $\beta 96^\circ 40'$. X-Ray photographs give a_0 17.42, b_0 9.12, c_0 9.50 Å., $a_0:b_0:c_0 = 1.908:1:1.040$; space-group probably C_{2h}^4 , 4 mols. per unit cell, and $\rho_{\text{calc.}}$ 3.23. New crystallographic forms are recorded.
L. S. T.

Size of the unit cell and the coefficient of expansion of high-cristobalite. J. S. Lukesh (*Amer. Min.*, 1942, 27, 226).— a_0 for artificial high-cristobalite is 7.031(7) Å. at 275° , and 7.044(0) Å. at 480° .
L. S. T.

Equilibrium studies on mixtures of pyroxenes, pyroxenoids, melilites, and olivines containing lime, magnesia, alumina, and silica. E. F. Osborn (*Amer. Min.*, 1942, 27, 228).—Data for the system

CaSiO₃-diopside (I)-anorthite have been completed. Wollastonite [β -CaSiO₃ with (I) in limited solid solution] has a field of stability, but the alleged compound 5CaO, 2MgO, 6SiO₂ does not appear. The (I) in this system is aluminous. L. S. T.

Mineralogy of the [Rolla] Missouri hæmatite sinks. F. H. Pough (*Amer. Min.*, 1942, 27, 230).—The hæmatite (I) formed by oxidation of the sulphide varies in texture from soft red "paint ore" to cryst. specularite. Minor quantities of azurite, malachite, brochantite, olivenite, and native Cu are associated with the (I). Small amounts of an unidentified Cu vanadate were also found. The origin of the deposits is discussed. L. S. T.

Supergene magnetite. J. S. Brown (*Econ. Geol.*, 1943, 38, 137—148).—Evidence relating to occurrences of magnetite (I) believed to be of supergene origin is discussed. Such assemblages are common, but economically unimportant. The (I) is formed only below the H₂O table, or in a H₂O basin, where an unstable balance between oxidation and reduction tendencies exists, and a suitable precipitant such as CaCO₃, or a hydroxide, is present. The resulting (I) is usually fine-grained and associated with larger amounts of soft, earthy hæmatite. L. S. T.

Hydrothermal replacement in deep-seated iron ore deposits of the Lake Superior region. H. M. Roberts and M. W. Bartley (*Econ. Geol.*, 1943, 38, 1—24).—Hæmatite (I) deposits at Steep Rock Lake, Ontario, are regarded as hydrothermal replacements. A comparison with deposits of the Vermilion and Marquette Fe range is made, and current hypotheses as to origin are reviewed. The formation of massive (I) at great depth is explained. L. S. T.

Diffuse diffraction and disorder in maucherite. M. A. Peacock (*Amer. Min.*, 1942, 27, 229).—Rotation and Weissenberg photographs give a_0 3.422, c_0 21.83 Å., with the symmetry $D_{2h}^{19} = I4/amd$. The crystal as a rule has the composition Ni₁₁As₈ or Ni₁₂₋₁As₈, and the disorder is probably related to shortage in Ni. L. S. T.

Sternbergite and frieseite. M. A. Peacock (*Amer. Min.*, 1942, 27, 229).—Sternbergite (I), ρ 4.25, from Jáchymov, Bohemia, has a_0 6.62, b_0 11.58, c_0 12.65 Å., containing 8[AgFe₂S₃]; space-group $D_{2h}^{21} = Cmma$, or $C_{2v}^{15} = C2ma$ or $Cm2a$. Freiseite (II), ρ 4.18—4.31, has a_0 6.60, b_0 11.59, c_0 12.61 Å.; space-group as in (I). Powder photographs of (II) show only the pattern of pyrite (III) with weak extra lines corresponding with the strongest lines of (I). (II) appears to have altered by at. rearrangement to oriented (I) and (III) according to the scheme Ag₂Fe₂S₃ (II) \rightarrow 2AgFe₂S₃ (I) + FeS₂ (III). L. S. T.

Quartz veins in the Ouachita mountains of Arkansas and Oklahoma: their relationships to structure, metamorphism, and metalliferous deposits. H. D. Miser (*Econ. Geol.*, 1943, 38, 91—118).—The quartz veins and crystals, and the associated minerals, are hydrothermal deposits of probable magmatic origin. The metalliferous deposits of these mountains appear to have been formed at the time of the quartz vein deposition. L. S. T.

Amblygonite. C. Palache, W. E. Richmond, and C. W. Wolfe (*Amer. Min.*, 1943, 28, 39—53).—Amblygonite from Hebron, Maine, has a_0 5.18, b_0 7.11, c_0 5.03 Å., α 112° 02½', β 97° 49½', γ 68° 07½', and the unit cell contains 2[LiAlPO₄(OH,F)]. Crystal measurements give $a:b:c = 0.7255:1:0.7028$, α 111° 59½', β 97° 46½', γ 68° 16½'. L. S. T.

Aluminium-bearing scorodite from Hobart Butte, Oregon. R. M. Denning (*Amer. Min.*, 1943, 28, 55—57).—Evidence for an Al-bearing scorodite, with Al replacing Fe^{III}, is presented. L. S. T.

Grunerite in Western Australia. K. R. Miles (*Amer. Min.*, 1943, 28, 25—38).—New occurrences in W. Australia are described. Grunerite (I) has been found only amongst the metamorphosed banded Fe formations of the Older Greenstone Series of W. Australia. It has been formed as a result of the interaction of Fe and SiO₂ during recrystallisation of these rocks under conditions of both regional and contact thermal metamorphism. These metamorphosed banded Fe formations are similar in mineralogical and chemical composition, and probably origin, to the (I)-bearing rocks of the Lake Superior region. Mineralogy, optical properties, and chemical analyses of several samples of (I) are recorded and discussed. A blue-green hornblende often associated with the (I) is described. L. S. T.

Occurrence of sodic scapolite at Falls of French Creek, Pennsylvania. W. H. Tomlinson (*Amer. Min.*, 1943, 28, 110—113).—The occurrence and origin are described, and chemical analyses recorded. L. S. T.

Graphical representation of the calciferous amphiboles. A. F. Hallimond (*Amer. Min.*, 1943, 28, 65—89).—196 analyses of amphiboles have been calc. to at. ratios according to the standard formula (Ca,Na)₂Na₁₋₂(Mg,Al)₅(Si,Al)₈O₂₂(OH,F)₂. There is a well-defined upper limit at Ca = 2 atoms, and a fairly sharp lower limit to Si at 6 atoms. The analyses are represented on a triangular diagram having as co-ordinates the no. of atoms of Si, and the no. of alkali atoms allotted to the vacant space. Nearly all the present minerals

can be derived from tremolite by two substitutions, Al₄/Si₂Mg₂ and Na₂Al₂/Si₂, whilst a third substitution, NaAl/CaMg, gives rise to glaucophane-like minerals. A general relationship exists between the type of amphibole and the nature of the parent-rock. L. S. T.

Unique occurrence of bobierite, Mg₃(PO₄)₂·8H₂O. J. W. Gruner and C. R. Stauffer (*Amer. Min.*, 1943, 28, 339—340).—An occurrence in a fossil elephant tusk is described. Mg phosphate has developed from Ca phosphate to the complete exclusion of the Ca. L. S. T.

Preliminary description of the new mineral partridgeite. J. E. de Villiers (*Amer. Min.*, 1943, 28, 336—338).—Natural Mn₂O₃, found in the Postmasburg Mn ores associated with braunite (II) and sitaprite (III), is named *partridgeite* (I). (I) resembles (III) in the hand specimen, but unlike (II), is etched by a mixture of equal parts of H₂SO₄ (1:1) and 10% H₂O₂. Chemical analyses [C. F. J. van der Walt] of a ferri-ferrous (I) and a (II)-(I)-pyrolusite ore are given. L. S. T.

Gamagarite, a new vanadium mineral from the Postmasburg [Cape Province] manganese deposits. J. E. de Villiers (*Amer. Min.*, 1943, 28, 329—335).—*Gamagarite*, Ba₄(Fe,Mn)₂V₄O₁₅(OH)₂, prismatic monoclinic, dark-brown, hardness 4½—5, ρ 4.62; α 2.016, β 2.040, γ 2.130 (all ± 0.01), pleochroic, red-brown to salmon-buff, occurs in the Mn ores of this district. A chemical analysis [C. F. J. van der Walt] is given. L. S. T.

Iridescent garnet from the Adelaide mining district, Nevada. E. Ingerson and J. D. Barksdale (*Amer. Min.*, 1943, 28, 303—312).—Garnets from a CaO-rich layer in the contact zone of a granodiorite stock show brilliant iridescence both on striated crystal faces and in thin section. This is due to fine polysynthetic twinning, with the intensity of the iridescence dependent on the thickness of the individual lamellae. L. S. T.

Mineralogy of the calcium phosphates in insular phosphate rock. C. Frondel (*Amer. Min.*, 1943, 28, 215—232).—The chief constituent of insular phosphate rock is a member of the apatite (I) series, usually a carbonate-hydroxyl-fluorine-apatite. Collophane (II) is not an amorphous species distinct from (I). X-Ray investigation of insular and continental phosphate rock, fossil bone and teeth, urinary calculi, and other materials corresponding with (II) shows that (II) is a sub-microcryst. variety of (I). The name should be retained for fine-grained, isotropic, hydrous types of (I). The identity of other specimens of ill-defined Ca phosphates has been investigated by X-ray and optical methods, and the results are discussed. L. S. T.

Effect of electrolytes on the solubility of metal sulphides in vein solutions. R. M. Garrels (*Econ. Geol.*, 1941, 36, 848).—E.m.f. measurements of cells containing mixed electrolytes approximating to the composition of vein solutions show that (i) addition of electrolytes to metal sulphide solutions may increase or decrease the solubility many thousand-fold, (ii) small amounts ($>0.1M$) of electrolytes increase the solubility of metal sulphides, and (iii) the effect of larger amounts of electrolytes is unpredictable, and may cause a further increase in solubility, or a rapid decrease, depending on the system involved. L. S. T.

Relationship of the clay minerals halloysite and endellite. L. T. Alexander, G. T. Faust, S. B. Hendricks, H. Insley, and H. F. McMurdie (*Amer. Min.*, 1943, 28, 1—18).—Chemical, electron-microscopical, X-ray, and petrographical investigation show that halloysite (I), Al₂Si₂O₅(OH)₄, is formed by partial dehydration of the more highly hydrated, related mineral now called endellite (II), Al₂Si₂O₅(OH)₄·2H₂O, and that (I) has the same type of Al silicate layers as kaolinite, but the layers are usually superimposed in a less orderly manner. (II) has a structure in which kaolinite-type layers alternate with single layers of H₂O mols. (II) may be formed by alteration of the constituents of a basic igneous rock, or its metamorphic equiv. Chemical analyses of (II), dehydrated at 110°, are recorded. L. S. T.

Formation of petroleum. A. Treibs (*Angew. Chem.*, 1940, 53, 202—204).—Petroleum is derived from marine plankton deposits such as occur in the Black Sea. The conversion cannot have been due to high temp. since porphyrins and optically active constituents have survived; rather was it due to biochemical elimination of O as H₂O and CO₂ under anaerobic conditions. Different types of petroleum may have resulted from differential adsorption in neighbouring strata of hydrocarbons of the aliphatic, naphthenic, and aromatic series. Asphalt is not a product of cracking or oxidation since its H:C ratio is nearly the same as that of petroleum. It is probably derived from biological material of special character which yielded primarily an oil containing reactive constituents. A. R. PE.

Origin and composition of coals.—See B., 1943, I, 318.

Coal measure sequence in the Taff Valley, Glamorgan, and its correlation with the Rhondda Valley sequence. L. R. Moore and A. H. Cox (*Proc. S. Wales Inst. Eng.*, 1943, 59, 189—265).

OCTOBER, 1943.

I.—SUB-ATOMICS.

Theory of complex spectra. III. G. Racah (*Physical Rev.*, 1943, [ii], 63, 367—382; cf. A., 1943, I, 77).—Consideration of the phases of the fractional-origin coeffs. allows the extension of matrix methods to configurations with >2 equiv. electrons. Origins of p^n and d^n terms are tabulated. Applications are made to the spin-orbit interaction of the d^n terms and to the electrostatic interaction between the configurations d^n , $d^{n-1}s$, and $d^{n-2}s^2$. N. M. B.

Measurements on X-ray production and absorption in the range 0.7—2.5 Mv. A. A. Petrauskas, L. C. Van Atta, and F. E. Myers (*Physical Rev.*, 1943, [ii], 63, 389—399).—The intensity and total mass absorption coeff. of the heterogeneous radiation produced in a thick Au target were measured as a function of tube voltage, angle with the electron beam, and thickness and material of the filter. Absorption coeff.-voltage curves are given for Pb, Sn, Cu, Al, C, and H_2O absorbers. A method is described for calculating the absorption coeff. at a given tube voltage with given filtration. Measured and calc. coeffs. are in good agreement. Intensity-angle curves are in qual. agreement with approx. theory. Absorption coeff.-angle and forward intensity-voltage curves are given. A method of calculating the efficiency of X-ray production from these data gives agreement with theory in the range 0.90—2.35 Mv. N. M. B.

Lead equivalence of thallium with respect to X-rays. R. Jaeger (*Physikal. Z.*, 1940, 41, 398—399).—The thicknesses of Pb and Tl which produce the same reduction in intensity of X-rays were determined. For the softest X-rays the protective action of Tl with respect to Pb increases with greater homogenisation. This effect is not so marked with harder rays. It depends on the position of the K-absorption edges for Tl and Pb. A. J. M.

Stark effect and its connexion with thermodynamics and magnetic behaviour of chrome alum at low temperatures. Z. W. Ku (*Physikal. Z.*, 1940, 41, 291—296).—The wave-mechanical method of Slater is used to examine the thermodynamic properties of Cr^{+++} . At sufficiently low temp. an increase of susceptibility with decreasing temp. is expected. Van Vleck's theory of dipole-dipole coupling is used to obtain formulæ for entropy and sp. heat in the case where there is no external field. A. J. M.

Polarisability of the hydrogen atom. H. Scheffers (*Physikal. Z.*, 1940, 41, 399—401).—Various experiments with at. H rays in an electric field indicate that the atoms have a velocity corresponding to a temp. of 600° K. instead of room temp. This leads to a val. for the polarisability of the H atom of $(6 \pm 2) \times 10^{-25}$ c.c., which agrees with wave mechanics but not with the Bohr theory. A. J. M.

Fundamental equation of quantum mechanics. H. T. Flint (*Phil. Mag.*, 1943, [vii], 34, 496—502).—Mathematical. A method for modifying Schroedinger's equation for a particle of charge e and mass m in an electromagnetic field by taking account of the magnetic moment of the particle is given. W. R. A.

Recombination law for weak ionisation. P. J. Nolan (*Proc. Roy. Irish Acad.*, 1943, 49, A, 67—90).—The recombination equation, $q = dn/dt = -an^2$, has been investigated in the case of weak ionisation, the ionic concn. being determined by applying a high field. The law holds over the range of ionisation considered (1500—12,000 ions per c.c.) if q is determined from rate of growth. Vals. of q determined from saturation currents are $>$ those from rate of growth. The results are applied to atm. ionisation. The normal val. of a is 1.41×10^{-6} c.c. per sec.; it is independent of concn. and of time after the initial period of non-random distribution has elapsed. A. J. M.

Low-velocity scattering of H^- and H_3^+ in hydrogen. J. H. Simons, C. M. Fontana, E. E. Muschlitz, jun., and S. R. Jackson (*J. Chem. Physics*, 1943, 11, 307—312).—The analytical determination of potential laws from low-velocity scattering measurements is discussed. Scattering measurements are recorded for H^+ and H_3^+ in H_2 at 2—135 v. The potential law changes with ion velocity; e.g., for H^+ in H_2 , $V = -20.37 \times 10^{-32}/r^4$ at 2—24 v. and $-8.68 \times 10^{-14}/r^{1.74}$ at 24—135 v. (distance of closest approach, $r_0 > 1.74$ and $1.74—1.5$ A., respectively). This gives interaction energy 3.0 e.v. 245 K (A., I.)

For H_3^+ in H_2 the average val. of V is $1.145 \times 10^{-36}/r^{4.60}$ at 5.4—130 v. and $-5.98 \times 10^{-32}/r^4$ at 10.5—28 v. (r_0 2.12—1.07 and 1.85—1.48 A.). In the case of H_3^+ , but not of H^+ , the potential law found agrees with a law calc. assuming that the only interaction is with the induced dipole of H_2 . L. J. J.

Low-velocity scattering of H_3^+ in hydrogen. Determination of neutralisation. J. H. Simons, C. M. Fontana, H. T. Francis, and L. G. Unger (*J. Chem. Physics*, 1943, 11, 312—316).—Neutralisation cross-sections for H_3^+ in H_2 have been determined at 4—30 v. The potential law is $V = 10.0 \times 10^{-32}/r^4$ at 10—25 v. and $6.96 \times 10^{-24}/r^3$ at >25 v. (r_0 2.14—1.70 A. and <1.70 A., respectively); the const. is \gg that in interaction due to polarisability of H_2 . L. J. J.

Scattering of low-velocity hydrogen ions in water vapour. J. H. Simons, H. T. Francis, E. E. Muschlitz, jun., and G. C. Fryburg (*J. Chem. Physics*, 1943, 11, 316—321).—The elastic scattering of H^+ , H_2^+ , and H_3^+ in H_2O vapour has been measured at 2—130 v. For H^+ the potential law is $V = -6.33 \times 10^{-32}/r^4$ at 3—15 v. (r_0 2.74—1.77 A.), giving 6.5 e.v. for the H^+ affinity of H_2O at equilibrium distance 1.013 A. At >15 v. the r exponent increases to ~ 20 . For H_2^+ , $V = -193 \times 10^{-56}/r^7$ at 3—20 v. (r_0 3.14—2.33 A.), the r exponent increasing to ~ 13 at >20 v. For H_3^+ , $V = -8.7 \times 10^{-16}/r^2$ at 5—20 v. (r_0 4.27—2.33 A.), in agreement with dipole-charge interaction. The exponent of r increases to ~ 8 at 30—60 v. Neutralisation is found with H^+ and H_2^+ , but not with H_3^+ . A Knudsen gauge is described. L. J. J.

Scattering of low-velocity hydrogen ions in helium. J. H. Simons, E. E. Muschlitz, jun., and L. G. Unger (*J. Chem. Physics*, 1943, 11, 322—328).—No neutralisation of H^+ , H_2^+ , or H_3^+ is found in He. For H^+ at 3—130 v. (r_0 2.66—0.55 A.), $V = 1.36 \times 10^{-18}/r^{2.27}$; for H_2^+ at 4—50 v. (r_0 1.67—0.87 A.) and 50—120 v. (r_0 0.87—0.66 A.) $V = -1.47 \times 10^{-32}/r^4$ and $-1.31 \times 10^{-32}/r^4$, respectively, while for H_3^+ in the ranges 1.5—14, 14—65, and 65—130 v. (r_0 2.22—1.59, 1.59—1.12, 1.12—0.89 A.) $V = -3.9 \times 10^{-53}/r^{6.88}$, $-1.06 \times 10^{-24}/r^{4.48}$, and $-4.83 \times 10^{-24}/r^{3.01}$, respectively. The interaction energy of H^+ with He to form HeH^+ is 3.27 e.v. for equilibrium distance 0.8 A. The interaction of H_2^+ with He agrees with mol. polarisation by an ionic charge. An exact analytical treatment of scattering is given. L. J. J.

Sparking in hydrogen. W. Fucks and F. Kettel (*Z. Physik*, 1940, 116, 657—692).—The square-root rule for the variation of relative decrease in spark potential with density of foreign current has been verified in the case of H_2 . A. J. M.

Retardation and neutralisation of argon ions in helium. W. J. Hamm (*Physical Rev.*, 1943, [ii], 63, 433—438).—An apparatus is described for making direct measurements of the loss of forward velocity of A ions in single encounters with He atoms. Results are given as collision cross-sections for given % retardations, for ion energies 1000—200 e.v. The cross-sections are zero for energy losses $>33.1\%$ and increase with decreasing % loss and with decreasing beam speed. A correction to the necessary readings is itself the cross-section for charge exchange between the A ions and He atoms. Approx. vals. are $3.5—4.5 \times 10^{-18}$ sq. cm. per mol. in the energy range studied, compared with 28×10^{-18} for A^+ in A and 63×10^{-18} for N_2^+ in N_2 . N. M. B.

At. wt. of ytterbium. C. Honigschmid and F. Hirschbold-Wittner (*Z. anorg. Chem.*, 1941, 248, 72—76).—From the ratios $YbCl_3 : 3Ag : 3AgCl$, $Yb = 173.10$. F. J. G.

Antisymmetrical interaction in β -decay theory. C. L. Critchfield (*Physical Rev.*, 1943, [ii], 63, 417—425).—Mathematical. N. M. B.

Scattering of neutrons by protons. L. Hulthén (*Physical Rev.*, 1943, [ii], 63, 383).—Mathematical. Results of Amaldi *et al.* (A., 1943, I, 112) for the angular distribution of fast neutrons scattered by protons favour a neutral meson theory of nuclear forces, and disagree with the theory of Møller and Rosenfeld (*Kgl. Danske Vidensk. Selsk. Math.-fys. Medd.*, 1940, 17, No. 8). N. M. B.

Calculation of absorption in highly concentrated radium preparations. H. Fränz and C. Weiss (*Physikal. Z.*, 1940, 41, 345—348).—The absorption of γ -rays in highly conc. Ra preps. cannot be determined directly, but must be calc. The absorption functions

of a cylindrical specimen, and of a cylindrical section cut parallel to the axis, are calc. The absorption coeff. must be known. The determination of true Ra content is discussed. A. J. M.

Putting tagged atoms to work. J. A. Timm (*J. Chem. Educ.*, 1943, 20, 54—59).—A review of transmutation, and applications of the products of transmutation. L. S. T.

Disintegration scheme of ^{24}Na . L. G. Elliott, M. Deutsch, and A. Roberts (*Physical Rev.*, 1943, [ii], 63, 386—387; cf. Mandeville, A., 1943, I, 47).—A repetition of experiments with improved accuracy confirms the presence of only two γ -rays, of energies 1.38 ± 0.03 and 2.76 ± 0.06 Me.v., and intensity ratio 0.9:1 ($\pm \sim 15\%$). N. M. B.

γ -Rays from ^{24}Na and ^{140}La . C. E. Mandeville (*Physical Rev.*, 1943, [ii], 63, 387—388).—Anomalies in previous data are discussed. NaF was irradiated with slow neutrons from a cyclotron. The momentum distribution of the Compton recoils of γ -rays from ^{24}Na shows that the spectrum consists of two electron groups with energies 1.38 ± 0.03 and 2.94 ± 0.06 Me.v., and intensity ratio 0.84, confirming the results of Elliott *et al.* (cf. preceding abstract). The momentum distribution of the Compton recoils of the γ -rays from ^{140}La shows marked symmetry. The γ -rays appear to be monochromatic, with energy 2.04 ± 0.04 Me.v., as found by Weimer (cf. A., 1943, I, 174). The similarity of the ^{24}Na 2.9-Me.v. γ -ray peak to the Th-C + C' 2.62-Me.v. γ -ray peak is noted. The theoretical status of ^{24}Na is critically reviewed. N. M. B.

New determinations of the atmospheric pressure and temperature effects with cosmic rays. F. Göttlicher and W. W. Dittrich (*Physikal. Z.*, 1940, 41, 402—406).—The variation in atm. pressure and temp. effects with cosmic rays has been investigated by means of a special arrangement of counters. The temp. effect is very small and varies in sign, although it is usually negative. This agrees with the fact that the total intensity at sea level is largely made up of mesons. The pressure effect is negative. A. J. M.

Intensity of cosmic rays at low altitude and the origin of the soft component. K. Greisen (*Physical Rev.*, 1943, [ii], 63, 323—333).—The separate intensities of fast mesotrons, slow mesotrons, and electrons are deduced from the differences between the absorption curves of cosmic rays at low altitude with C, Fe, and Pb absorbers. Results indicate considerable production of low-energy mesotrons at low altitudes, and that $<$ half the energy of the mesotrons goes to the electron component. N. M. B.

Mesotron mass and heavy tracks on Mt. Evans. C. E. Nielsen and W. M. Powell (*Physical Rev.*, 1943, [ii], 63, 384—385).—Preliminary mass data (giving 145—240e for the mass of a slow mesotron) are reported from an analysis of 4 of the 6 tracks of heavily-ionising mesotrons identified in ~ 7000 Wilson cloud-chamber photographs. N. M. B.

Direct measurement of the mean life of the meson at rest. R. Maze and R. Chaminade (*Compt. rend.*, 1942, 214, 266—268).—A coincidence method, depending on the selection of a group of electrons arising from the disintegration of the meson in Pb or Al, is described (cf. A., 1942, I, 191). The val. found is $\tau_0 = 10^{-8}$ sec. ($\pm 30\%$). N. M. B.

Production of bursts by the meson and its dependence on the meson spin. S. K. Chakrabarty (*Indian J. Physics*, 1942, 16, 377—392).—An analytical expression for the calculation of the frequency of bursts containing $\propto N$ particles produced by a meson has been derived and tested against experimental data, vals. of 0, $\frac{1}{2}$, and 1 being used for the meson spin. For a meson, spin 0 or $\frac{1}{2}$ is not possible, but spin 1 is probable provided that certain conditions are satisfied. For large bursts the radiation process predominates and the contribution of the knock-on process is insignificant. W. R. A.

Theory of a mixed pseudoscalar and a vector meson field. W. Pauli and S. Kusaka (*Physical Rev.*, 1943, [ii], 63, 400—416; cf. A., 1943, I, 384).—Mathematical. N. M. B.

Meson theory of the magnetic moment of proton and neutron. J. M. Jauch (*Physical Rev.*, 1943, [ii], 63, 334—342).—Mathematical. The magnetic moment is found by a second-order perturbation method, a new limiting process securing the convergence of the integration in momentum space. The results for pseudoscalar and vector mesons are the same, and lead to a positive magnetic moment for the neutron if the magnetic moment of the vector meson is assumed to be one meson magneton. The theory disagrees with known vals. of magnetic moments of heavy particles. N. M. B.

II.—MOLECULAR STRUCTURE.

Spin doubling in the doublet Σ states of CO^+ . L. H. Woods (*Physical Rev.*, 1943, [ii], 63, 431—432).—From available photographs of the CO_2 spectrum, showing the first negative bands and the comet-tail bands of CO^+ , in which the $^2\Sigma$ spin splittings were resolved, measurements were made and signs determined for the abs. vals. of the spin doubling coeffs. N. M. B.

Silicon oxide bands. L. H. Woods (*Physical Rev.*, 1943, [ii], 63, 426—430).—Bands described by Pankhurst (cf. A., 1940, I, 429) have been excited by a high-voltage uncondensed discharge through a constriction in a quartz tube, but in He instead of H_2 . Data and analyses for bands photographed by a grating spectrograph are tabulated. A band near λ 3840 Å. was resolved in the first and second orders and found to be a (0, 0) transition overlapped by a weak (1, 1) transition of the type $^2\Sigma \rightarrow ^2\Sigma$. Consts. and coeffs. of spin doubling for the two states are evaluated; the results prove that the emitter is SiO^+ . Other bands at λ 4270 Å. have been resolved with weak intensity and provisionally ascribed to SiO_2 . N. M. B.

Structure of the electronic bands of the OD molecule. VI. Isotopic shift. M. G. Sastry (*Indian J. Physics*, 1942, 16, 343—346; cf. A., 1943, I, 4).—The vibrational and rotational isotopic shifts in the OH and OD band heads have been calc. from the consts. for OH; derived vals. of the total shift are in poor agreement with experimental data. If an electronic shift exists, it is $< 1 \text{ cm}^{-1}$. W. R. A.

Band spectrum of SnSe in emission. R. F. Barrow and E. E. Vago (*Proc. Physical Soc.*, 1943, 55, 326—328).—The spectrum was excited by a heavy-current uncondensed discharge through the vapour of Sn and Se, and a well-developed system of red-degraded bands in the region 3420—4040 Å. was photographed and identified with the C absorption system (cf. Walker *et al.*, A., 1938, I, 116). Measurements for ~ 20 new bands of this system are tabulated and an equation for the band-heads is derived. Fainter bands to the short- λ side of the system were measured; these may form a fourth system of SnSe involving the same lower state. N. M. B.

Molecular bands in the violet and near ultra-violet spectra of Mira Ceti. H. Grouiller (*Compt. rend.*, 1942, 214, 256—258).—Data for bands of TiO and CN are tabulated. Comparison of known CH lines in the solar spectrum with lines of Mira Ceti gives no conclusive evidence of the presence of CH in the star. N. M. B.

Production of emission spectra of organic molecules by electron collision in the glow discharge. H. Schüler, H. Gollnow, and A. Woeldike (*Physikal. Z.*, 1940, 41, 381—386).—A d.c. glow-discharge tube, in which it is possible to excite the emission spectra of org. mols. by electron collision, is described. The spectra of C_6H_6 , PhCl, C_{10}H_8 , and COMe, have been investigated. The states excited by the glow discharge are not the same as those excited by light. Decomp. may occur, in which case characteristic spectra due to the products are observed. Previously undescribed bands of CO were detected at 3150—4050 Å. A. J. M.

Visible absorption bands of mercury halides, HgCl, HgBr, and HgI. A. L. S. Rao (*Indian J. Physics*, 1942, 16, 393—397).—By heating the substances in an open steel tube to 1100° the absorption bands have been obtained. The band systems of HgCl and HgBr have been measured; a vibrational analysis is suggested, and from the vals. of the consts. the heats of dissociation of these mols. in the upper and lower electronic states are determined. With HgI intense red absorption bands of I have been obtained. W. R. A.

Dimeric and other forms of methylene-blue. Absorption and fluorescence of the pure monomer. G. N. Lewis, O. Goldschmid, T. T. Magel, and J. Bigeleisen (*J. Amer. Chem. Soc.*, 1943, 65, 1150—1154).—A dimeric methylene-blue (I) ion occurs in conc. 95% EtOH solutions at 110°K . Absorption curves of the monomeric ion have been measured in EtOH at room temp. and, by extrapolation, at 110°K . The latter curve is identical with that of leuco-(I), after illumination in a rigid solvent. Absorption of polymerised (I) mols., in solvents of low ϵ , has been measured. In H_2O and M-KCl and - KNO_3 solutions much of the dye is in a colourless form, produced by addition of OH^- to the central N and H' to amino-N. Comparison of fluorescence and absorption spectra shows that subsidiary absorption bands are due to vibrational resolution of one electronic band. W. R. A.

Infra-red absorption of pyridine vapour. J. Turkevich and P. C. Stevenson (*J. Chem. Physics*, 1943, 11, 328—329).—Measurements of 11 absorption max. between 662 and 3070 cm^{-1} are recorded. L. J. J.

Fluorescence of monomethine-cyanine dyes, particularly reversibly polymeric monomethine-cyanines. II. F. Katheder (*Kolloid-Z.*, 1940, 93, 28—50).—The quenching effect of H^+ and OH^- on solutions of the diethochlorides of ψ -isocyanine and mononaphtho- ψ -isocyanine shows min. at pH ~ 4 and ~ 10 , and decreases with rise of temp. The quenching effect of pyrocatechol is slight, but with polymeric forms of the dyes it is considerable. The possibility of propagation of the excitation energy in the polymerised mols. is suggested as the reason for this difference. A kinetic theory of quenching is developed and applied to the calculation of the degree of polymerisation from quenching data. For the two dyes investigated degrees of polymerisation of 10 — 10^5 , depending on dye concn., have been calc. C. R. H.

Chlorophyll fluorescence and energy transfer in the diatom *Nitzschia closterium*. H. J. Dutton, W. M. Manning, and B. M. Duggar (*J. Physical Chem.*, 1943, 47, 308—313).—Fluorescence

measurements on *N. closterium*, using *Chlorella pyrenoidosa* as a control, show that the quantum yields of chlorophyll (I) fluorescence are fairly const. over the λ range 4358–6000 Å. for the exciting light. Since absorbed yellow light appears as (I) fluorescence, it may be concluded that carotenoid-sensitised photosynthesis takes place through the transfer of absorbed energy from carotenoid mols. to (I) mols.; the subsequent reactions are the same as those which occur when (I) mols. are the primary absorbers. In COMe₂ extracts of *N. closterium* there is little or no energy transference.

C. R. H.

Fluorescing substances in dried egg powders.—See B., 1943, III, 215.

Energy distribution in the phosphorescence spectrum of oxygen. (Mme.) R. Herman and L. Herman (*Compt. rend.*, 1942, 214, 261–263).—Energy distribution curves, compared with those of black-body emission at 2538° and 4730° K., indicate that the spectrum consists of a wide band having a max. at ~6200 Å. and a narrower band with a max. at ~6700 Å. The intensities depend on the excitation conditions. The intensity of the wide band decreases towards short λ and tends to zero at ~3900 Å., suggesting that the band is due to NO₂.

N. M. B.

Transformation of energy in crystalline phosphors. F. Möglich and R. Rompe (*Physikal. Z.*, 1940, 41, 236–242).—Theoretical. The interaction of electrons with the phosphor lattice and with each other is considered. The electron energy in the upper band of a phosphor (e.g., ZnS) is discussed.

A. J. M.

Raman spectra of four pairs of meso- and dl-disubstituted butanes. H. J. Taufen, M. J. Murray, and F. F. Cleveland (*J. Amer. Chem. Soc.*, 1943, 65, 1130–1134).—Raman spectra of the meso- and dl-forms of (CHMe·OH)₂, (CHMe·OAc)₂, (CHMeBr)₂ and (CHMeCl)₂ have been investigated. The spectra of meso- and dl-forms show distinct differences. Multiplicity of some lines establishes the existence of rotational isomerides in the dihalogenated butanes, in agreement with dipole moment data.

W. R. A.

Raman spectra of hydrocarbons. III. Diisobutylene, cyclohexene, and dipentene. F. F. Cleveland (*J. Chem. Physics*, 1943, 11, 301–306; cf. A., 1943, I, 193).—Raman $\nu\nu$, relative intensities, and depolarisation factors have been determined for diisobutylene (I), cyclohexene (II), and dipentene (III). Olefinic $\nu\nu$ for (I) agree with those for β -methyl- Δ^a -heptene, with ν 1376 cm.⁻¹ replacing that at 1414 cm.⁻¹. The $\nu\nu$ 1653 and 3023 cm.⁻¹ of (II) appear at 1682 and 3012 cm.⁻¹ in the case of (III). Errors in the author's previous work (*loc. cit.*) are indicated.

L. J. J.

Raman spectra of l-ascorbic acid, tetronic acid, and related compounds. J. T. Edsall and E. L. Sagall (*J. Amer. Chem. Soc.*, 1943, 65, 1312–1316).—Raman spectra of aq. solutions of l-ascorbic (I), d-glucoscorbic, isoscorbic, tetronic (II), and α -nitrotetronic (III) acids and their Na salts, of PhOH and NaOPh in H₂O, of (I) and (III) in MeOH, and of (I) in D₂O have been determined. A very strong line at 1700 cm.⁻¹ is shifted to 1595 cm.⁻¹ when the ascorbic acids ionise. (II) shows a much smaller shift, whilst (III) and NaOPh exhibit no appreciable changes on ionisation.

W. R. A.

Photo-electric investigations with luminous substances. L. Bergmann and F. Ronge (*Physikal. Z.*, 1940, 41, 349–355).—A no. of technical fluorescent substances which show little or no after-glow have a definite photo-electric effect, of which the max. occurs at $\lambda\lambda$ for which excitation of fluorescence is max. The connexion of the photo-electric effect with the mechanism of fluorescence and phosphorescence is discussed. The extinction of luminescence brought about by infra-red rays is a photo-electric phenomenon.

A. J. M.

Dependence of secondary electron emission from insulators on the angle of incidence [of the primary electrons]. H. Salow (*Physikal. Z.*, 1940, 41, 434–442).—Mica, glass, and ZnS were examined. A formula for the dependence of the secondary emission on the voltage and angle of incidence (α) of the primary electrons is deduced on the basis of the Widdington-Thomson law for energy consumption of the primary electrons, the absorption of secondary electrons being assumed \propto path. A sudden change of the secondary emission with α , found by Wehnelt, could not be confirmed.

A. J. M.

Dielectric properties of animal fibres.—See B., 1943, II, 280.

Dipole moments of palmitic acid, aleuritic acid, and alkyl esters of aleuritic acid. G. N. Bhattacharya (*Indian J. Physics*, 1942, 16, 369–376).—The dipole moments in dioxan at 25° for palmitic acid and Me and Et aleuritides are 1.75, 4.27, and 4.31 D., respectively. Aleuritic acid (I) in dioxan at 40° gives 4.28 D. The cause of the anomalous solubility of (I) and its esters in polar solvents is discussed with respect to solvation and dissolution of the highly polar mols.

W. R. A.

Molar refraction and structure of hydroxymethylene ketones.—See A., 1943, II, 252.

Magneto-optic rotation. IV. Acetic and chloroacetic acids in polar and non-polar solvents. V. Selenium oxychloride in aqueous solutions. C. E. Waring, S. Steingiser and H. H. Hyman (*J. Amer. Chem. Soc.*, 1943, 65, 1066–1068, 1068–1070).—IV. ρ , n , and

K 2 (A 1)

magneto-optic rotation of aq. AcOH, CH₂Cl·CO₂H, CHCl₂·CO₂H, and CCl₃·CO₂H solutions have been determined; vals. for AcOH in CCl₄ and CS₂ have been recalcd. from previous data. Verdet consts., mol. Verdet consts., and mol. refractivities of the solutions have been calc. Mol. Verdet consts. are \propto concn., suggesting that association has no effect on the intramol. electronic configuration.

V. Vals. of ρ and magneto-optic rotation of aq. SeOCl₂ have been determined. Verdet and mol. Verdet consts. of the solutions have been calc. The plot of the mol. Verdet consts. against concn. shows a break at 33.3 mol.-% of SeOCl₂, due to the formation of SeOCl₂·2H₂O, which causes an alteration in the internal electronic configuration. The structure of SeOCl₂·2H₂O is discussed.

W. R. A.

Electro-negativity scale of elements. T. H. Liu (*J. Chinese Chem. Soc.*, 1942, 9, 119–124).—The electro-negative character of an element can be quantitatively represented as a function $(n + 2.6)/3.2r^{2/3}$ of the no. of valency electrons (n) and the at. radius (r) in Å. The derived electronegativity scale systematises the typical properties of oxides, hydrides, and halides.

L. J. J.

Forces between hydrogen molecules. H. Margenau (*Physical Rev.*, 1943, [ii], 63, 385–386).—An outline of the calculation of intermol. forces having regard to exchange forces.

N. M. B.

Molecular volume and structure. V, VI. T. W. Gibling (*J.C.S.*, 1943, 146–148, 149–153).—V. From a consideration of parachors of org. compounds the following are the chief standard group vals. (S.V.) which have been calc.: (C)·CH₂·(N), 39.6; (C)·NO₂, 76.8; (C)·O·N=O, 75.3; (C)·N=N·(C), 51.8; (C)=N=N, 53.2; (C)·N=N=N, 79.9; (C)·CN, 66.6; (C)·NC, 66.8. Structural peculiarities are discussed, and interference corrections are assessed. Corrections in alkyl chains are: CN; β , -1.3; γ , -0.8; δ , -2.6; ϵ , -1.1 (total, -5.8).

VI. The following S.V. are also calc.: (C)·NH₂, 47.9; $\left(\begin{smallmatrix} C \\ O \end{smallmatrix}\right) > NH$, 32.0 (ideal S.V., 35.1); $\left(\begin{smallmatrix} C \\ O \end{smallmatrix}\right) N \cdot (C)$, 13.0 (ideal S.V., 22.3); (C)·OH, 39.2; (C)·O·(C), 21.5 (ideal S.V., 26.7); (C)·CH₂·(O), 39.4; (O)·CH₂·(O), 38.3; $\left(\begin{smallmatrix} O \\ O \end{smallmatrix}\right) > CH \cdot (C)$, 19.9; $\left(\begin{smallmatrix} O \\ O \end{smallmatrix}\right) > CH \cdot (O)$, 17.7; (C)·CH₂Cl, 96.1; (C)·CH₂Br, 110.3; (C)·CH₂I, 131.6; $C < \begin{smallmatrix} C \\ N \end{smallmatrix}$, -2.4; $N < \begin{smallmatrix} C \\ C \end{smallmatrix}$, -3.1; $C < \begin{smallmatrix} O \\ O \end{smallmatrix}$, -2.6; $C < \begin{smallmatrix} O \\ O \end{smallmatrix}$, -3.7; $O < \begin{smallmatrix} C \\ C \end{smallmatrix}$, -5.2. Corrections in alkyl chains for Br and I are: γ , -0.7; δ , -1.5; ϵ , -0.6 (total, -2.8).

C. R. H.

Molecular surface energy of sulphur dioxide addition compounds. II. J. R. Bright and J. J. Jasper (*J. Amer. Chem. Soc.*, 1943, 65, 1262–1263).— ρ , γ , and η of NEt₃·SO₂ at 0–30° have been measured, and the influence of temp. on the mol. surface energy determined. The val. of 386.0 for the parachor agrees with that calc. on the basis of N–O–S linking.

W. R. A.

III.—CRYSTAL STRUCTURE.

Derivation of the 32 point-groups. J. D. H. Donnay (*Amer. Min.*, 1942, 27, 220).—Symmetry is re-defined. Symmetry operations are of two kinds only, rotation and rotatory inversion. General theorems on symmetry are re-cast in the form of eight propositions conforming to the concept of inversion axes instead of reflexion axes or planes of alternating symmetry. A simplified derivation of the 32 point-groups is based on these eight theorems. Advantages of this derivation are pointed out.

L. S. T.

Morphological expression of tetragonal space-groups. J. D. H. Donnay (*Amer. Min.*, 1942, 27, 220).—The 68 tetragonal space-groups are distributed among 31 morphological aspects, 23 in the P-C lattice and 8 in the I-F lattice.

L. S. T.

Wide-angle diagram with X-ray or electron beams as a reciprocal lattice diagram of the atomic texture of crystals. H. Seemann (*Physikal. Z.*, 1940, 41, 365–380).

A. J. M.

X-Ray line broadening by cold-working α -brass. M. Petersen and C. W. Tucker (*Physical Rev.*, 1943, [ii], 63, 385).—Experiments reported do not confirm that the X-ray diffraction line broadening is enhanced by speed of working, as found by Niemann and Stephenson (cf. A., 1943, I, 53).

N. M. B.

Composition of X-rays scattered by a crystal subjected to thermal agitation. J. Laval (*Compt. rend.*, 1942, 214, 274–276).—Mathematical.

N. M. B.

Structure of liquid xenon. J. A. Campbell and J. H. Hildebrand (*J. Chem. Physics*, 1943, 11, 334–337).—The diffraction of Ag K α radiation by liquid Xe at -110° and 1 atm. (sp. vol. 0.324 c.c. per g.), and at -90° and 2.5 and 130 atm. (sp. vol. 0.339, 0.324 c.c. per g. respectively), has been examined. The no. of nearest neighbours is 9–10 at 4.43–4.50 Å. The sp. vol. has a greater effect than the temp. on the structure.

L. J. J.

Structure of liquid mercury. J. A. Campbell and J. H. Hildebrand (*J. Chem. Physics*, 1943, 11, 330–333).—The diffraction of

Mo $K\alpha$ radiation by liquid Hg at six temp. between -38° and 200° has been examined. The first peak is at 3.00 Å. at all temp., with 5.3—6.0 atoms in the first co-ordination layer. L. J. J.

Crystal structure of minium. S. T. Gross (*J. Amer. Chem. Soc.*, 1943, 65, 1107—1110).—The crystal structure of Pb_3O_4 has been determined by X-ray analysis. Pb^{IV} ions, as in PbO_2 , are co-ordinated with chains of O octahedra, which share opposite edges. Each Pb^{II} ion is co-ordinated with 3 O atoms of the parallel Pb^{IV} chains. The structure is thus built up of alternate red PbO and PbO_2 units. The space-group is $P4b2$. W. R. A.

Laminar disperse hydroxides and basic salts of bivalent metals. W. Feitknecht (*Kolloid-Z.*, 1940, 92, 257—276; 93, 66—86).—The general equilibrium conditions for basic salts and hydroxides of bivalent metals are given, and the val. of X-ray spectrographic measurements in helping to explain the "secondary structure of primary particles" is discussed. The salt/hydroxide ratio of basic salts depends on the conditions of formation, but the ratio is often a simple one. The stable hydroxides of Mg, Cd, Ni, and Co crystallise in the C6 lattice and possess a "simple-layer lattice," whereas the unstable or α -hydroxides possess a "double-layer lattice" in which layers of hydroxide are separated by unimol. layers of amorphous hydroxide. The α -form is thus intermediate between the cryst. and amorphous forms. The structure of double hydroxides is similarly discussed, and lattice dimensions of these and of α -hydroxides are tabulated. During the crystallisation of basic salts or hydroxides between the lattice layers, one or several of the following can occur: high dispersion; laminar formation; lattice "roughening"; displacement of lattice layers or layer bundles (Arnfelt structure); changes in lattice dimensions and layer distances. Published data on the hydroxides and basic salts of the metals mentioned and of Zn are summarised, and discussed with reference to the views expressed. C. R. H.

X-Ray crystallography of burkeite, $2Na_2SO_4 \cdot Na_2CO_3$.—See A., 1943, I, 268.

Unit cell and space-group of kaliophilite.—See A., 1943, I, 268.

Structural relations between high- and low-chalcocite.—See A., 1943, I, 268.

X-Ray examination of crystalline forms of anhydrous sodium stearate at room temperature. A. de Bretteville, jun. (*Amer. Min.*, 1942, 27, 215—216).—The monoclinic B form is the most stable, and is due to a shortening of the c axis by 2.4 Å. owing to a rearrangement of the dipolar CO_2Na group. There is a shift of alternate mols. of 180° around the c -axis. The tilt of the C chain for the monoclinic B form is probably equal to that of the A form, viz., 62.9° . L. S. T.

Orientation in stretched films of amylose triacetate. R. L. Whistler and N. C. Schieltz (*J. Amer. Chem. Soc.*, 1943, 65, 1436—1437).—X-Ray diffraction studies on stretched films of amylose triacetate, with and without plasticiser, reveal that they are highly cryst., with a periodicity of 18.3 Å. along the fibre (b) axis. W. R. A.

Reactivity of cotton fibre and type of X-ray diffraction pattern.—See B., 1943, II, 280.

Intermolecular forces and chain configuration in linear polyamides. Effect of N -methylation on the X-ray structure and properties of linear polyamides. W. O. Baker and C. S. Fuller (*J. Amer. Chem. Soc.*, 1943, 65, 1120—1130).—Young's modulus (E), sorption of H_2O , and solubilities in $EtOH-CHCl_3$ of 9 N -methylated polydecamethylene sebacamides, with 0—55% substitution, have been measured. E and hardness decrease, sorption of H_2O and solubility increase, with N -methylation, owing to the disappearance of H-bonds and polar forces. X-Ray investigation reveals inter-chain spacings essentially unchanged by the substitution, but the distance between dipole layers and the fibre identity period are shortened, with retraction of the chain. W. R. A.

M.p. and unit cell dimensions of symmetrical halogenobenzenes. T. Beacall (*Trans. Faraday Soc.*, 1943, 39, 214—216).—Substitution of Br for Cl in the symmetrical compounds increases the m.p. in the same ratio as it increases the linear dimensions of the unit cell. F. L. U.

X-Ray crystallographic studies of α -etioporphyrin-1. C. L. Christ and D. Harker (*Amer. Min.*, 1942, 27, 219).—Goniometric and X-ray measurements show that the point-group is $2/m$. Oscillation photographs of single crystals show that the structure is monoclinic with a_0 10.3 ± 0.1 , b_0 19.5 ± 0.1 , c_0 6.75 ± 0.05 Å., β $98^\circ \pm 1^\circ$; space-group $P2_1/c$, with 2 mols. per unit cell. The probable structure of the porphyrin mol. is discussed, and a model for the α -etioporphyrin-1 mol. proposed. L. S. T.

Structure of methylenecyclobutane and hexamethylethane. L. H. Bauer and J. Y. Beach (*Amer. Min.*, 1942, 27, 214—215).—Electron diffraction shows that in methylenecyclobutane the C atoms are coplanar, four of them being situated at the corners of a square of side 1.56 ± 0.03 Å., and the fifth on an extension of one of the diagonals, 1.34 ± 0.02 Å. from the C in the ring. The radial distribution curve for C_2Me_6 indicates that the central C—C bond distance is

stretched (1.58 ± 0.02 Å.); other distances are C—C 1.54 ± 0.02 Å. and C—H 1.09 Å. (assumed), and the C valency angles are $110^\circ \pm 2^\circ$. L. S. T.

Polymorphism of bismuth trioxide. W. C. Schumb and E. S. Rittner (*J. Amer. Chem. Soc.*, 1943, 65, 1055—1060).—Tetragonal (β), monoclinic (α), and body-centred cubic (γ) forms of Bi_2O_3 have been prepared. α is stable below 710° , at which the β -form becomes the stable modification. No region of stability has been found for the γ -phase, which has a_0 10.245 Å. Previously reported body-centred and simple cubic forms of Bi_2O_3 are shown to have contained impurities, probably SiO_2 . Solubility of Bi_2O_3 in NaOH, up to 2.46M., is $\propto [NaOH]$, the mol. species in solution being $NaBiO_2$. W. R. A.

IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

Galvanomagnetic investigation of the mechanism of electrical conductivity of barium. E. Justi and J. Kramer (*Physikal. Z.*, 1940, 41, 197—202).—The effect of temp. and magnetic field strength on the resistance of Ba of various degrees of purity has been determined at 1.85—273° K. and with a transverse field (H) of $>35,000$ Gauss. Without the external field the resistance decreases more slowly than a T^4 law, and deviations from the Nernst-Matthiessen rule occur, probably owing to the bivalency of Ba. The increase of resistance (Δr) with H is approx. $\propto H^2$. The reduced Kohler diagram shows that the observed Δr vals. approach a quadratic function of H/r , where $r = r_T/r_0$ ($\theta = 116^\circ$), which is independent of variations in temp., H , and residual resistance. For the same vals. of H/r , Δr is $>$ that for any other cubic metal. A. J. M.

Galvanomagnetic experiments on the mechanism of the electrical conductivity of single crystals of cadmium. E. Justi, J. Kramer, and R. Schulze (*Physikal. Z.*, 1940, 41, 308—325).—The resistance (r) of single crystals of Cd was determined at 273—4.22° K., in a transverse magnetic field (H) of 37,000 Gauss. The normal r for $H = 0$ decreases approx. according to a $T^{2.5}$ law. The effect of the magnetic field was determined with the field parallel to, and also perpendicular to, the principal hexagonal axis, [0001]. Δr parallel to the [0001] axis was approx. isotropic, but that perpendicular to this axis was strongly anisotropic. The anisotropy factor is 1.77 at room temp., decreasing to a min. at 20.4° K., below which it rises again. The variation of Δr with field strength and temp. for a given orientation obeys Kohler's law to a first approximation. A. J. M.

Electrical conduction and recrystallisation in thin lead films deposited at low temperatures. E. L. Armi (*Physical Rev.*, 1943, [ii], 63, 451—454; cf. Foster, A., 1940, I, 103).—Resistance-time measurements were made for Pb films deposited by evaporation in high vac. on glass plates cooled by liquid H_2 . Conduction began in films of thickness ~ 7 Å. Ageing of these films at various temp. showed the existence of an equilibrium temp., above or below which ageing was accompanied by an increase or a decrease of resistance, respectively. Possible explanations are given. N. M. B.

Correlation of fringes near the K X-ray absorption discontinuity and electrical conductivity in haematite, magnetite, and pyrites. C. Kurylenko (*Compt. rend.*, 1942, 214, 271—274).—Numerical data for these minerals, based on the application of Kronig's theory of the fringes, indicate that the high conductivity of the minerals is due to the high energy of the valency electrons. N. M. B.

Magnetochemistry. S. Sugden (*J.C.S.*, 1943, 328—333).—Ninth Liversidge lecture. The determination of mass susceptibility, the connexion between diamagnetism and at. and mol. structure, and the effect of temp. on diamagnetism are discussed. The relation between the stereochemistry of complex compounds and their magnetic properties, and the general magnetic behaviour of complex compounds, are reviewed. A. J. M.

Comparison of the magnetic properties of solid and powdered magnetites, with observations on coercive force. E. F. Herroun (*Proc. Physical Soc.*, 1943, 55, 338—343, 432).—Data are tabulated for several specimens, from different localities, of magnetites in the form of bars cut from the solid mineral and bars formed from the powdered mineral bound with gelatin and compressed. Results indicate that permeability (μ) is much reduced by powdering, the reduction being greater for magnetites of higher initial μ ; max. μ is reached at higher forces with powders than with the solids; coercivity is increased for magnetites of low initial coercivity, but decreased for those of high coercivity, while for some of intermediate val. there is very little change. The persistence of magnetic structure is discussed. N. M. B.

Ferromagnetic impurities. II. F. W. Constant, R. E. Faires, and H. E. Lenander (*Physical Rev.*, 1943, [ii], 63, 441—445; cf. A., 1939, I, 555).—Attempts to render traces of impurities (probably Fe) non-magnetic by heat-treatment showed that heating Cu at 900° and brass at 750° in H_2 for <2 hr., followed by quenching, would eliminate the ferromagnetism. This method was not successful with Ag. Results are interpreted in terms of the crystal structure of the metals and of Fe. Reheating Cu to 900° in an atm. containing

O₂ restored strong ferromagnetism; this is attributed to the diffusion of O₂ into the Cu at high temp. The effect of heat-treatment at other intermediate temp. on the magnetic hardness and hysteresis of the impurity was also investigated. N. M. B.

Magnetochemical investigations. I. Introduction and experimental technique. II. Diamagnetic susceptibility of the CH₃ group. III. Diamagnetic susceptibility of isomerides. W. R. Angus and W. K. Hill (*Trans. Faraday Soc.*, 1943, 39, 185—190, 190—197, 197—201).—I. A modified Gouy method is described.

II. Measurements of the susceptibility (χ) of 39 highly purified liquids, members of homologous series of hydrocarbons, alcohols, acids, and esters, are recorded. Analysis of the data by Pascal's method gives $\chi_{CH_3} = -11.68 \pm 0.02$, and by the method of Farquharson and Sastri (*A.*, 1938, I, 20), which is considered the more accurate, -11.69 ± 0.003 . Conversion of an acid into its Me ester gives -10.66 . An *iso*-compound is more diamagnetic than its *n*-isomeride.

III. Branching of a hydrocarbon chain increases χ , the order among isomeric compounds being *tert.* > *sec.* > *iso* > *n*. For *n*- and *iso*-isomerides the more diamagnetic compound has the lower b.p., *d*, and η . An *iso*-compound is more diamagnetic than the corresponding *n*-compound, and a monocarboxylic acid than isomeric esters, by ~ 1 unit. F. L. U.

Absorption of ultrasonic waves in gases. H. H. Keller (*Physikal. Z.*, 1940, 41, 386—393).—The optical method of investigating the absorption of ultrasonic waves in gases (cf. Petersen, *A.*, 1940, I, 235) has been developed. The apparatus was calibrated using A, and the absorption in N₂, NH₃, CO₂, and a mixture of CO₂ and 8% H₂ was investigated at various pressures. The absorption in A, N₂, and NH₃ agrees approx. with the formula $\alpha = k\nu^2$ (α = energy absorption coeff.) required by classical theory, although there was some deviation with N₂ and NH₃ due to relaxation of the rotational energy. In the case of CO₂ and CO₂ + H₂, the relaxation was more marked, and agreed qualitatively with theory. A. J. M.

Specific heats of nickel, bismuth, and phosphorus. O. Kubaschewski and G. Schrag (*Z. Elektrochem.*, 1940, 46, 675—680).—The mean sp. heats of Ni (22° to 396—1040°), Bi (23° to 112—483°), and red P (22° to 390—480°) have been measured. The results are shown graphically, and probable errors of the measurements are calc. For Ni at 650—1050°, $c_p = 0.1047 + 2.78 \times 10^{-6}\theta$. The latent heat of fusion of Bi is 2.63 kg.-cal. per g.-atom. R. Ke.

Specific heats at low temperatures of anhydrous chlorides of calcium, iron, magnesium, and manganese. K. K. Kelley and G. E. Moore (*J. Amer. Chem. Soc.*, 1943, 65, 1264—1267).—Vals. of C_p at 51—298° K. for anhyd. CaCl₂, FeCl₂, MgCl₂, and MnCl₂ have been determined. Vals. of $S_{298.15^\circ}$ are 27.2 \pm 0.4, 28.7 \pm 0.8, 21.4 \pm 0.2, and 28.0 \pm 0.8 g.-cal. per degree per g.-mol., respectively. Vals. of $\Delta G_{298.15^\circ}^\circ$ of formation are -179.8 , -72.6 , -141.5 , and -102.9 kg.-cal. per g.-mol. W. R. A.

Heat content of manganese dioxide and carbonate at high temperatures. G. E. Moore (*J. Amer. Chem. Soc.*, 1943, 65, 1398—1399).—Vals. of H for MnCO₃ (420—660° K.) and MnO₂ (340—730° K.) have been determined. Equations are given for $H_T - H_{298.15^\circ}$, $S_T - S_{298.15^\circ}$, and C_p . W. R. A.

Thermal data. XVI. Heat capacity and entropy of isopentane. Absence of a reported anomaly. G. B. Guthrie, jun., and H. M. Huffman (*J. Amer. Chem. Soc.*, 1943, 65, 1139—1143).— C_p of Pr^{is}Et has been measured calorimetrically at 13—300° K. The m.p. is 113.37 \pm 0.05° K., and ΔH of fusion 1232.2 \pm 1.0 g.-cal. per g.-mol. The val. of $S_{298.15^\circ}$ from C_p data is 62.24 \pm 0.10 g.-cal. per degree per g.-mol. Anomalous behaviour of C_p in the range of 180—240° K., reported by Aston *et al.* (*A.*, 1942, I, 292), was not encountered. W. R. A.

Heat capacity and entropy, heats of transition, fusion, and vaporisation, and vapour pressure of cyclohexane. Vibrational frequencies of alicyclic ring systems. J. G. Aston, G. J. Szasz, and H. L. Fink (*J. Amer. Chem. Soc.*, 1943, 65, 1135—1139).—Vals. of C_p of solid and liquid cyclohexane have been determined calorimetrically at 12.6—293.8° K. The transition point is 186.09 \pm 0.05° and m.p. 279.84 \pm 0.05° K. ΔH of transition, fusion, and vaporisation are 1593.3 \pm 1.5, 627.8 \pm 1.8, and 7967 \pm 8 g.-cal. per g.-mol. The v.p. of liquid cyclohexane has been measured at 280—294° K. Vibrations have been assigned by comparing entropy vals. from calorimetric and spectroscopic data, a chair configuration being assumed for the mol. W. R. A.

Thermodynamics of styrene, including equilibrium of formation from ethylbenzene. L. Guttman, E. F. Westrum, jun., and K. S. Pitzer (*J. Amer. Chem. Soc.*, 1943, 65, 1246—1247).— C_p of CHPh:CH₂ at 15—300° K. has been measured. ΔH of fusion is 2617 g.-cal. per g.-mol. The v.p. (p mm.) at 0—60° is represented by $\log_{10} p = -2604.67T^{-1} - 2.57692 \log_{10} T + 15.90485$. $S_{298.15^\circ}$ of CHPh:CH₂ as ideal gas at 1 atm. is 82.07 g.-cal. per degree per g.-mol. Equilibrium consts., at 381—1000° K., of the dehydrogenation of PhEt to CHPh:CH₂ have been calc. W. R. A.

Molecular state of acetic acid vapour. Experiment in gaseous equilibrium. R. H. Wright (*J. Chem. Educ.*, 1943, 20, 179—182).—Apparatus and procedure for investigating pressure-vol. relationships of AcOH vapour at different temp. are described. L. S. T.

Effect of high electrostatic fields on (A) the vaporisation of molybdenum, (B) the vaporisation and resistance of molybdenum filaments. (A) G. B. Estabrook. (B) W. P. Reid (*Physical Rev.*, 1943, [ii], 63, 352—358, 359—366).—(A) For wires of varying diameters, field strengths (X) $> \sim 0.52 \times 10^6$ v. per cm. at the wire surface caused no change in rate of change of resistance with time, and hence in the rate of vaporisation (v) on application of the field; as X was increased above $\sim 0.52 \times 10^6$ v. per cm., v decreased, first slowly, then more rapidly, and finally asymptotically towards 0 at $X > 1.8 \times 10^6$ v. per cm.; with increasing temp. the same X applied at the surface of a wire produced progressively smaller decreases in v ; when there was an effect on v , the resistance increased suddenly when the field was applied and decreased suddenly when it was removed.

(B) Equations are obtained to fit the above variation of v with X on the assumption that the vaporisation decrease is due to the formation of an adsorbed gas layer on the filament. Time-lags in relation to the formation and removal of gas layers are discussed, and certain postulates are proposed. N. M. B.

Cloud formation by withdrawal of heat by thermal conduction. F. Trey (*Physikal. Z.*, 1940, 41, 415—418).—It is shown theoretically that it should be possible to produce a cloud by cooling a closed vessel containing air and saturated H₂O vapour. By cooling a cylindrical vessel by means of a coil through which passed cold CO₂, cloud formation was observed, as well as condensation on the walls. A. J. M.

Properties of fluids. S. C. Bradford (*Phil. Mag.*, 1943, [vii], 34, 433—471; cf. *A.*, 1938, I, 123).—Mathematical. The following properties have been calc., without introduction of arbitrary consts., by Newton's dynamics from Maxwell's kinetic theory and Edser's inverse eighth power law of mol. attraction: mean paths of mols.; potential energy; latent heat; association, cohesion, and surface tension of associated liquids; v.p. of an associated liquid; thermal conductivity and viscosity of gases; viscosity of liquids. Vals. accurate to 2 significant figures are obtained in good agreement with experimental data. W. R. A.

Simple derivation of the existence of a critical temperature. F. L. Hahn (*J. Chem. Educ.*, 1943, 20, 233—234). L. S. T.

Accommodation coefficients of helium, neon, argon, hydrogen, deuterium, oxygen, carbon dioxide, and mercury on platinum as a function of temperature. L. B. Thomas and F. Olmer (*J. Amer. Chem. Soc.*, 1943, 65, 1036—1043).—The accommodation coeffs. have been calc. from the theoretical heat conductivity and the measured power losses from an electrically heated Pt filament in a vac. and in gas at pressures up to 0.05 mm. The theoretical distribution of temp. along the filament has been calc., the results indicating the importance of having a uniform filament temp. An apparatus has been designed to fulfil this condition. Plots of measured and existing vals. of accommodation coeffs. against temp., for use with the Pirani gauge, are given. W. R. A.

Viscosity of ethylene glycol. E. Estel (*Physikal. Z.*, 1940, 41, 413—415).—Vals. of η are given at close temp. intervals from 22.84° to 75.57°. The log η -temp. curve is shown. A. J. M.

Energies for self-diffusion in zinc. H. B. Huntington (*Physical Rev.*, 1943, [ii], 63, 383—384; cf. *A.*, 1943, I, 262).—Diffusion is more rapid along the hexagonal axis than in the basal plane (cf. Miller and Banks, *A.*, 1942, I, 322). Explanations from energy considerations are examined. N. M. B.

V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

Aliphatic hydrocarbon densities. Correlation in the critical region. T. G. Stevenin and J. G. Allen (*Ind. Eng. Chem.*, 1943, 35, 788—789).—Curves correlating density with reduced pressure at reduced temp. 0.70—2.40 and reduced pressure up to 5.0 are given. The curves are applicable to paraffins with 2—5% deviation, and applicable to some extent to olefines. L. J. J.

Viscosity of methane-propane system. L. B. Bicher, jun., and D. L. Katz (*Ind. Eng. Chem.*, 1943, 35, 754—761).—Data for η of CH₄, C₃H₈, and mixtures with 20, 40, 60, and 80 mol.-% CH₄ are recorded for temp. 77—437° F. and 400—5000 lb. per sq. in. pressure. Correlation by mol. wt., pseudo-reduced temp., and pseudo-reduced pressure gives a relation valid for any light paraffin or hydrocarbon mixture with $\sim 3.5\%$ average error. L. J. J.

Calculation of relative volatility. (A) R. Edgeworth-Johnstone. (B) J. Griswold. (*Ind. Eng. Chem.*, 1943, 35, 826).—A new formula for relative volatility (α_T) for non-polar liquids A + B, $\log \alpha = [1 - (T_A/T)] \log T_A + [(T_B/T) - 1] \log T_B + [(T_B/T) - (T_A/T)] \log R$, where P represents v.p. at temp. T , $T_{A,B}$ represents b.p. 1 atm., is given. L. J. J.

Anomalous osmotic effects in chain molecules. III. Summary of previous results. F. Klages (*Kolloid-Z.*, 1940, **93**, 19—28).—Published data, mainly for sugars and allied compounds, are reviewed. C. R. H.

Long-chain molecules in aqueous urea solution. R. E. D. Clark (*Nature*, 1943, **151**, 642).—2% aq. $\text{CO}(\text{NH}_2)_2$ (I) shows continuous friction, but 20% aq. (I) exhibits friction of a new type characterised by periodic movement sensitive to pH changes. The effect is attributed to formation of fibrils from chain-like mols., and this view is supported by other evidence. In such a chain intermediate dipoles would cause lateral attraction between chains, and the end charges would serve to attach chains to interfaces. A. A. E.

Viscosity of mixed solutions containing three and four ionic species. A. S. Chakravarti (*J. Indian Chem. Soc.*, 1943, **20**, 41—44).—Data on η for mixed salt solutions are recorded. They are represented by $\eta/\eta_0 = 1 + A\sqrt{c} + Bc$ in which A and B are linear functions of composition. F. J. G.

Configurative relationship between optical active methyl- and thiol-succinic acid.—See A., 1943, II, 251.

Magnetic properties of solid solutions. III. Paramagnetic alloys of copper and nickel. A. R. Kaufmann and C. Starr (*Physical Rev.*, 1943, [ii], **63**, 445—450; cf. A., 1941, I, 405).—Susceptibility measurements as a function of temp. (14—1273° K.) and applied field are tabulated and plotted. A Curie-Weiss equation cannot represent the results, but an equation of the form $\chi = aT + b + (c/T)$ is satisfactory. Alloys in the range 30—38% Ni show considerable field-dependence of the susceptibility at low temp. N. M. B.

Thermal diagram of the system iron-tin. W. F. Ehret and D. H. Gurinsky (*J. Amer. Chem. Soc.*, 1943, **65**, 1226—1230).—A phase diagram of the system Fe-Sn is described. Lattice consts. of the intermediate phases Fe_2Sn , Fe_3Sn_2 , γ (~62% Sn), FeSn , and FeSn_2 , all possessing hexagonal symmetry, are described. The high-temp. γ phase has the NiAs structure. W. R. A.

Diffusion rates of carbon in iron-molybdenum and iron-tungsten alloys. R. Smoluchowski (*Physical Rev.*, 1943, [ii], **63**, 438—440; cf. A., 1942, I, 122).—Measurements show that W and Mo in face-centred Fe at 1000° slow down the diffusion of C, the influence of W being > twice that of Mo. There appears to be no connexion between the variation in Fe lattice parameter and the variation in C diffusion rate. N. M. B.

Solubility of hydrogen at low pressures in iron, nickel, and steels. M. H. Armbruster (*J. Amer. Chem. Soc.*, 1943, **65**, 1043—1054).—The solubilities of H_2 at 400°, 500°, and 600° and pressures between 0.001 and 1.5 mm., in α -Fe, Ni, and 13 steels, and in α -Fe at 600° and pressures up to 350 mm. have been determined, and are $\propto p^{1/2}$. Heats of dissolution have been calc. Solubility in ferritic mild steels is similar to that in α -Fe; vals. for austenitic and high-alloy content steels approximate to the solubility in Ni. W. R. A.

Solubility of ammonium bromide in alcoholic solvents. M. E. Bedwell (*Trans. Faraday Soc.*, 1943, **39**, 205—206).—The solubilities of NH_4Br in MeOH, EtOH, and Pr°OH have been determined at 10° intervals from 0° to near the b.p. of the saturated solutions. The solubility-temp. curve for each solvent shows a break between 30° and 40°, which is attributed to a change in the degree of solvation. The mean ionic radius of the dissolved salt, calc. by Bjerrum's theoretical formula, is in a const. ratio of 1.21 to the experimental cryst. val. ($a/2$). F. L. U.

Complex compounds. II. Solubility of silver bromide in aqueous hydrobromic acid. III. Solubility of silver iodide in aqueous hydriodic acid. W. Erber (*Z. anorg. Chem.*, 1941, **248**, 32—35, 36—44).—II. Solubility data for AgBr in aq. HBr at 0° and 25° are given. They accord with the formation of a complex $[\text{Ag}_2\text{Br}_6]^{4-}$ having a stability const. = 1.3×10^{10} and a heat of formation = 19.5 kg.-cal. per g.-mol. of AgBr .

III. Solubility data for AgI in aq. HI at 0° and 25° are given. They accord with the formation of a complex $[\text{Ag}_2\text{I}_6]^{4-}$ having a stability const. = 1.0×10^{18} and a heat of formation = 26.5 kg.-cal. per g.-mol. of AgI . F. J. G.

Sorption of water vapour by soap curd. J. W. McBain and W. W. Lee (*Ind. Eng. Chem.*, 1943, **35**, 784—787).—Anhyd. soap takes up 1—2% of H_2O by physical sorption before forming a hemihydrate at 40—70% R.H. H_2O is then taken up more rapidly up to 10—12% by a sorption law with $1/n > 1$, indicating the presence of capillary H_2O in interstices. Finally a new phase forms. Na oleate forms no hemihydrate. Higher hydrates readily revert to hemihydrate when the R.H. falls by $> 15\%$. L. J. J.

Adsorption of riboflavin by lactose.—See B., 1943, III, 212.

Equilibrium between lens and unilayer in the system hydrocarbon oil-oleic acid-water, in relation to the interfacial film. E. Heymann and A. Yoffe (*Trans. Faraday Soc.*, 1943, **39**, 217—219).—It is suggested that the negative sign of the final spreading coeff. of paraffin oil, containing oleic acid as spreader, on H_2O (cf. A., 1942, I, 360) is related to the fact that the lateral adhesion between the spreader mols. is smaller in the interface than in the surface. Measurements of the surface and interfacial pressures when a lens of oil containing oleic acid is in equilibrium with a surface film of the latter are recorded and the relation between them is discussed. F. L. U.

Veratrine alkaloids. XVIII. Surface film studies. A. Rothen and L. C. Craig (*J. Amer. Chem. Soc.*, 1943, **65**, 1102—1106).—Films of the veratrine alkaloids (I) and solanidine (II) have been investigated. Mol. measurements of (I), from these films, show that six hydroaromatic rings are so arranged that max. length (18 Å.) and min. cross-sectional area (47 sq. Å.) are obtained. The vals. agree well with the dimensions of a proposed linear formula. (II) gives films very similar to those of (I) and has approx. equal mol. dimensions. W. R. A.

Nature of the electrical double layer. D. C. Grahame (*J. Chem. Educ.*, 1943, **20**, 154).—The electrical double layer is regarded as being composed of a compact layer of specifically adsorbed ions and a diffuse layer of non-adsorbed ions. L. S. T.

Burton's rule for positive hydrosols. II. Coagulation measurements. H. Kauffmann (*Kolloid-Z.*, 1940, **93**, 86—103).—Coagulation measurements on various metal oxide and hydroxide sols under varying conditions show that the Burton rule is valid for the electrogenic CuO and Al_2O_3 sols and partly valid for the chemogenic $\text{Fe}(\text{OH})_3$ and $\text{Cr}(\text{OH})_3$ sols. C. R. H.

Charge and stability of colloids. III. Potentiometric titrations of ferric hydroxide sol. IV. Potentiometric titrations of aluminium hydroxide sol. B. P. Yadava (*J. Indian Chem. Soc.*, 1943, **20**, 115—119, 123—126).—III. Potentiometric titrations of Cl^- displaced on addition of a no. of electrolytes at varying concn. to $\text{Fe}(\text{OH})_3$ sols, made by dialysis of FeCl_3 , show that with progressive dialysis the amount of Cl^- released for a given addition of electrolyte diminishes, being > that equiv. to the added electrolyte for the more impure, and < this val. for the purer, sols.

IV. $\text{Al}(\text{OH})_3$ sols give results corresponding with those found with $\text{Fe}(\text{OH})_3$, except for KNO_3 , which releases $\text{Cl}^- < \text{equiv.}$ to the KNO_3 at all degrees of purity of the sol. L. J. J.

Effect of H-ion concentration on viscosity changes in thorium phosphate gel-forming mixtures during setting. (Miss) A. Nathan (*J. Indian Chem. Soc.*, 1943, **20**, 56—61).—Variation of η with time during the setting of Th phosphate gels at different pH is recorded. In general the rate of change of η with time increases when the pH is reduced to a certain val.; further reduction of pH causes a decrease. F. J. G.

Opacity changes in gel-forming mixtures during setting. I. Thorium molybdate, stannic arsenate, and silicic acid gels. M. Prasad and V. S. Gogate (*Proc. Indian Acad. Sci.*, 1943, **A**, **17**, 161—170).—An improved apparatus for measuring opacity changes during gelation is described. The effects of adding HCl and salts have been investigated. Changes in opacity appear to be related to changes in the no., size, distribution, anisotropy, and arrangement of micelles of the gel. W. R. A.

Sedimentation and diffusion behaviour of nucleic acid preparations. See A., 1943, II, 245.

VI.—KINETIC THEORY. THERMODYNAMICS.

Vapour-phase esterification over zirconium oxide. W. J. Knox, jun., and T. N. Burbridge (*J. Amer. Chem. Soc.*, 1943, **65**, 999—1001).—The equilibrium $\text{EtOH} + \text{AcOH} \rightleftharpoons \text{EtOAc} + \text{H}_2\text{O}$, over ZrO_2 at 200°, 150°, and 125°, has been investigated. Vals. of equilibrium consts. and ΔG° have been calc. W. R. A.

Reactions of organic silicic acid compounds. I. Association in systems of silicic esters and alcohols. (Frl.) L. Holzapfel (*Z. Elektrochem.*, 1941, **47**, 327—329).— ρ , n , and η of Et, Me, and isoamyl silicates have been determined. Electrical conductivities of mixtures of EtOH with C_6H_{14} , Et and Me silicates, of MeOH with Me silicate, and of iso- $\text{C}_8\text{H}_{17}\text{OH}$ with isoamyl silicate (I), and η of Me and Et silicate-EtOH, and (I)-iso- $\text{C}_8\text{H}_{17}\text{OH}$ mixtures have been determined. The effect of association on the variation of η and electrical conductivity of these mixtures with concn., and on the prevention of polymerisation of $\text{Si}(\text{OH})_4$ by org. OH-compounds, is discussed. W. R. A.

Revision of the constants of the Debye-Hückel theory. P. van Rysselberghe (*J. Amer. Chem. Soc.*, 1943, **65**, 1249).—Consts. h and g of the Debye-Hückel expression for $\log \gamma$ of a z_1z_2 -valent electrolyte in aq. solution at 25° have been recalcd. from the revised consts. of Birge (*Rev. Mod. Phys.*, 1941, **13**, 233). W. R. A.

Constants of the Debye-Hückel theory. G. Scatchard (*J. Amer. Chem. Soc.*, 1943, **65**, 1249—1250).—The equations of Scatchard and Epstein (*Chem. Rev.*, 1942, **30**, 211) for the Debye-Hückel limiting law expressions are revised, using the vals. of fundamental consts. given by Birge (*Rev. Mod. Phys.*, 1941, **13**, 233). W. R. A.

Complex ions. IV. Monoammine silver ion. W. C. Vosburgh and R. S. McLure (*J. Amer. Chem. Soc.*, 1943, **65**, 1060—1063).—Determination of the solubilities of Ag_2SO_4 , AgBrO_3 , and AgIO_3 in dil.

aq. NH_3 solutions have confirmed the existence of $\text{Ag}[\text{NH}_3]^+$ ions. The instability const. of $\text{Ag}[\text{NH}_3]^+$ is 4.3×10^{-4} , in agreement with the existing val. 4.8×10^{-4} . The dissociation const. of $\text{Ag}[\text{NH}_3]_2^+$ to Ag^+ and NH_3 , recalcd. from existing data, is 6.2×10^{-8} .

W. R. A.

Basic ionisation constant of glycine in dioxan-water solutions. H. S. Harned and C. M. Birdsall (*J. Amer. Chem. Soc.*, 1943, **65**, 1117—1119).—Basic ionisation consts. of glycine in dioxan- H_2O (20, 45, and 70% of dioxan) have been calc. from vals. of the e.m.f. of cells of the type $\text{H}_2|\text{Z}(m_1), \text{NaZOH}(m_2), \text{NaCl}(m_3)|\text{AgCl-Ag}$ ($\text{Z} = \text{NH}_3\text{CH}_2\text{CO}_2$ and NaZOH is hydrated $\text{NH}_3\text{CH}_2\text{CO}_2\text{Na}$), measured at 5° intervals from 0° to 50°. ΔG° , ΔH° , ΔC° , and ΔS° for the ionisation reaction at 25° have been calc.

W. R. A.

Modern theories of acids and bases. H. I. Stonehill (*J. Soc. Dyers and Col.*, 1943, **59**, 171—176).—A review.

C. S. W.

Acids and bases. Critical re-evaluation. R. Ginell (*J. Chem. Educ.*, 1943, **20**, 250—252).—A discussion in which it is concluded that neutralisation is the union of solvo-positive ions with solvo-negative ions, and that an acidic solution is one that contains a solvo-positive ion as one of the predominant species present, and a basic solution one that contains a solvo-negative ion as one of the predominant species. Acidity and basicity are thus properties of solutions and not of pure substances.

L. S. T.

Acid-base relationships at higher temperatures. L. F. Andrieth and T. Moeller (*J. Chem. Educ.*, 1943, **20**, 219—222).—The Brønsted and Lewis definitions are extended qualitatively to certain acid-base reactions at higher temp. regardless of the presence or absence of a liquid phase.

L. S. T.

Effect of dielectrics and solvent on the regeneration in acid solution of alkali-faded bromophenol-blue. E. S. Amis and J. B. Price (*J. Physical Chem.*, 1943, **47**, 338—348).—The regeneration of alkali-faded bromophenol-blue in aq., aq. MeOH, and aq. EtOH solutions of HCl at 25°, 35°, and 45° has been investigated. The data indicate a change in the mol. dispersion of the faded dye with changing acidity. In alcoholic solutions there is a lack of conformity to the predictions of the electrostatic and collision theories which is attributed to the formation of ROH_2^+ ions.

C. R. H.

Methylene-blue and other indicators in general acids. The acidity function. G. N. Lewis and J. Bigeleisen (*J. Amer. Chem. Soc.*, 1943, **65**, 1144—1150).—Addition of H^+ to aq. methylene-blue (I) occurs at the central N. The absorption spectrum of the new compound has a peak at a lower ν than that of (I). Capri-blue (II) adds H^+ to the amino-N, resulting in a band of higher ν , but a small amount of the isomeride with centrally added H^+ is also formed. A second H^+ adds in $>70\%$ H_2SO_4 , forming three isomerides with (I) and two with (II). Change in relative concn. of the former isomerides in the range 78% to fuming H_2SO_4 has been determined. Changes in the spectra of (I), (II), and Bindschedler's green are very similar on the addition of H^+ in H_2O or of BCl_3 or SnCl_4 in COMe_2 , MeCN , or PhCN . Phenolphthalein, eosin, and dinitrodibromoeosin (III) are indicators in 95% to fuming H_2SO_4 , SO_3 here acting as an acid. (III) has been used to extend the vals. of the acidity function of Hammett and Deyrup (A., 1932, 921) to concns. >50 mol.-% of SO_3 .

W. R. A.

Phase equilibria in hydrocarbon systems. Composition of dew-point gas in ethane-water system. H. H. Reamer, R. H. Olds, B. H. Sage, and W. N. Lacey (*Ind. Eng. Chem.*, 1943, **35**, 790—793).—The composition of the dew-point gas phase in $\text{C}_2\text{H}_6\text{-H}_2\text{O}$ systems at 100—460° F. and up to 10,000 lb. per sq. in. has been determined from samples from a static system. The general behaviour resembles that of $\text{N}_2\text{-H}_2\text{O}$ and $\text{CH}_4\text{-H}_2\text{O}$ systems. The mol. fraction of H_2O is ~ 5 times that predicted from simple v.p. considerations at the higher pressures and lower temp.

L. J. J.

High-pressure vapour-liquid equilibria. Vapour-liquid equilibrium of benzene-toluene.—See B., 1943, I, 349.

Relative weights of phases present in a heterogeneous system at equilibrium. W. M. Spicer and J. S. Metcalf (*J. Chem. Educ.*, 1943, **20**, 199).

L. S. T.

Ternary system dioxan-ethyl alcohol-water. C. H. Schneider and C. C. Lynch (*J. Amer. Chem. Soc.*, 1943, **65**, 1063—1066).—Vapour-liquid equilibria for the system dioxan- H_2O at 1 atm. have been determined. The min. azeotrope contains 48.5 mol.-% of dioxan and boils at 87.59°. Measurements of n and ρ for the analysis of dioxan-EtOH- H_2O mixtures are given, and an analysis diagram is drawn. Sufficient vapour-liquid equilibrium data at 1 atm. to estimate the ternary min. azeotrope of this system (4.2 mol.-% dioxan, 85.3 mol.-% EtOH, b.p. 78.08°) have been determined.

W. R. A.

VII.—ELECTROCHEMISTRY.

Variation of specific conductivity with concentration of electrolytes in aqueous solution. R. Gopal (*J. Indian Chem. Soc.*, 1943, **20**, 62—68).— κ for NH_4 and alkali (except Li) salts of mineral acids in

aq. solution increases steadily with concn. For most other sol. electrolytes, κ shows a max. at 20—30%.

F. J. G.

Limiting equivalent conductance of electrolytes. P. van Rysselberghe (*J. Chem. Educ.*, 1943, **20**, 131).

L. S. T.

Conductivity of sulphuric acid in methyl alcohol at 25°. E. W. Kanning, E. G. Bobalek, and J. B. Byrne (*J. Amer. Chem. Soc.*, 1943, **65**, 1111—1116).—Conductivity of 0.02107 to 6.006×10^{-5} M. solutions of H_2SO_4 in MeOH has been determined. At <0.002 M. mol. conductance is \propto (concn.)¹. H_2SO_4 in MeOH acts as a partly dissociated univalent electrolyte, with a dissociation const. of ~ 0.029 at 25°.

W. R. A.

Electrical conduction of textiles. S. Baxter (*Trans. Faraday Soc.*, 1943, **39**, 207—214).—Measurements of the electrical resistance of wool, collagen, silk, and cotton fibres at various temp. from 30° to 60° are described and recorded. Polarisation is marked in dry wool fibres (regain $<5\%$), but disappears at higher regains, at which Ohm's law is obeyed. Since the activation energy associated with the wool- H_2O system is larger, and is independent of pH over the range 2—8, and since the wool-MeOH system behaves similarly, it is inferred that the conduction is not ionic. The assumption that wool- H_2O behaves as an electronic semi-conductor leads to a simple relation between the resistance R and the regain m , viz., $\log R = a + b/\sqrt{m}$ (a and b const.), in agreement with the experimental results of Marsh and Earp (B., 1933, 298).

F. L. U.

Reversible oxygen electrode. W. G. Berl (*Trans. Electrochem. Soc.*, 1943, **83**, Preprint 19, 231—248).—A half-cell was constructed, using a C electrode, in which gaseous mol. O_2 was in equilibrium with one of its ions. It behaved in accordance with the thermodynamic predictions concerning the effect of changes in the activities of reactants and reaction products on the e.m.f. The ion with which O_2 establishes a reversible equilibrium in alkaline solution is HO_2^- , and the measured e.m.f. was in agreement with the calc. val. for the half-cell reaction $\text{OH}^- + \text{HO}_2^- \rightleftharpoons \text{O}_2 + \text{H}_2\text{O} + 2e$. This assumed reaction was verified by operating a cell containing the O_2 electrode so that the equilibrium of the above reaction could be displaced in either direction. This was done by connecting the O_2 electrode cathodically into either a galvanic or an electrolytic cell. Current efficiencies on the basis of the H_2O_2 yield in either instance were 100%.

C. E. H.

Electrolytically deposited metals. Influence of the gas above the electrolyte on the deposition potential. B. Kassube and H. Schmellenmeier (*Z. Elektrochem.*, 1941, **47**, 309—313).—The potential of the cathode surface, within the electrolyte and at the electrolyte-gas interface, in the electro-deposition of Zn, Sn, and Fe at various c.d. has been measured. With O_2 above the electrolyte the potential at the interface was $>$ that within the electrolyte; with H_2 they were approx. equal. Variation of the H_2 content of the deposited metal with c.d. influences the deposition potential and the structure of the deposit, and results in the non-superposability of the current/potential taken with increasing and decreasing current.

W. R. A.

E.m.f. measurements in liquid sulphur dioxide. K. Wickert (*Z. Elektrochem.*, 1941, **47**, 330—333).—Polemical against Cruse (A., 1943, I, 229) on the definition of the terms "acid" and "base" in liquid SO_2 solutions.

W. R. A.

Two-stage reversible electro-reduction, with the formation of semi-quinones and their dimerides, at the dropping mercury electrode. R. Brdička (*Z. Elektrochem.*, 1941, **47**, 314—326).—General equations have been derived for the current-potential curves in the polarographic reduction of reversible bivalent redox systems, including the separate and simultaneous formation of semi-quinones and their dimerides. By a mathematical analysis of the experimental curves the dismutation, dimerisation, and equilibrium consts. of the system may be evaluated. The effects, on the experimental results, of irreversibility and immobility of the equilibrium, of adsorption and insolubility of the components, and of internal resistance and pH, are qualitatively discussed.

W. R. A.

VIII.—REACTIONS.

Prediction of reaction rates. F. Daniels (*Ind. Eng. Chem.*, 1943, **35**, 504—510).—A review of the published information on reaction rates in homogeneous systems. The only reliable and consistent figures are obtained from gas-phase reactions of low orders, and in these the Arrhenius equation ($k = ae^{-Q/RT}$) can be applied. Vals. of a range from 10^{12} to 10^{14} , and abnormal vals. are related to disturbing factors such as chain reactions. In view of the multiplicity of such factors in most cases, it is considered better to predict relative rates rather than abs. vals.

F. Rd.

Organic reactions. H. Eyring, H. M. Hulburt, and R. A. Harman (*Ind. Eng. Chem.*, 1943, **35**, 511—521).—A short mathematical derivation of reaction rate from the sp. properties of an oscillating mol. system. The actual quantities involved can seldom be determined and show only the relative val. of factors such as change of vol. in the formation of suitably activated reacting complexes. Two types of complex are distinguished, in which the valency bonds

are respectively homopolar (shared electron) and polar, or ionic. The increase in reaction rate shown in many solvents may be due to formation of complex ions with part of the solvent mol. Such a mechanism may also be used to explain reactions at a solid surface, which behaves as an ionising solvent to adsorbed reactants. Metallic oxide catalysts can combine with both positive and negative ions and thus give two or more reactions. F. RD.

Viscometric method for studying alcoholysis of esters. A. J. Rao (*J. Indian Chem. Soc.*, 1943, 20, 69—75).—Measurement of η is a convenient method for studying alcoholysis. Data on the rate of alcoholysis of MeOAc by $C_6H_{11}OH$, Bu^iOH , and Pr^aOH at 25° and 30° in presence of HCl are recorded. F. J. G.

Laws governing growth of films on metals. U. R. Evans (*Trans. Electrochem. Soc.*, 1943, 83, Preprint 10, 8 pp.).—Derivations of three different types of growth laws are given and discussed. The linear law, $y = k_1t$, is obtained where the film is porous and O_2 or other non-metals can penetrate to the metallic surface. The parabolic law, $y^2 = k_2t + k_3$, is obtained when the film is non-porous and has ionic and electronic conductivity. Here the growth rate is governed by outward ionic migration, and is usually associated with vacant sites in the cationic lattice. The logarithmic law, $y = k_4 \log(k_5t + k_6)$, occurs when the conditions for parabolic growth are absent. It is explained by the outward passage of interstitial matter through flaws of loose structure in the outer part of the film. The three types of growth occur with Ca, Cu, and Zn, respectively. In the case of highly protective films, e.g., on Al, the rate of growth is largely governed by the formation of cracks in them. C. E. H.

Disproportionation of diphenyl-*o*-tolylmethyl.—See A., 1943, II, 258.

Kinetics of amylase action.—See A., 1943, III, 683.

Concept of catalytic chemistry. A. V. Grosse (*Ind. Eng. Chem.*, 1943, 35, 762—767).—A lecture. L. J. J.

Autoxidation of ascorbic acid. R. W. Peterson and J. H. Walton (*J. Amer. Chem. Soc.*, 1943, 65, 1212—1217).—The half- and 95%-life periods of the autoxidation of ascorbic acid, with the catalytic effect of Cu^{++} and org. compounds, have been determined. At pH < 8 the reaction is slow, but it accelerates rapidly in more alkaline solutions. In the presence of Cu^{++} the rate is large in acid and alkaline media, with a max. between pH 8 and 10, and a min. at pH 6—8, and an autocatalytic effect, probably caused by the monoester of $H_2C_2O_4$ and *l*-threonic acids. Order of reaction depends on pH. The vol. of O_2 absorbed varies with pH and $[Cu^{++}]$. Conc. of H_2O_2 produced could not be correlated with the vol. of O_2 absorbed or the rate of reaction. The inhibiting effect of 10 org. substances has been determined. W. R. A.

Stimulation of formation of additive compounds between bases and phenol derivatives by lipoid solvent. H. Bergstermann (*Biochem. Z.*, 1940, 304, 223—237).—The stimulation of the phenol-base addition reaction in the lipoid phase applies not only to nitrophenols and antipyrine but also to the biologically important phenols and bases. Data are given for the partition coeffs. between C_6H_6 and H_2O for the *o*-, *m*-, and *p*- $NO_2 \cdot C_6H_4 \cdot OH$ -antipyrine complexes. P. G. M.

Photographic development as a catalysed heterogeneous reaction. T. H. James (*J. Chem. Physics*, 1943, 11, 338—341).—Published data on kinetics of development of Ag halides by NH_2OH and quinol indicate that reduction proceeds along the solid Ag-Ag halide interface, by adsorbed developer ions. Ag filaments can be formed by migration of newly formed Ag along the Ag surface before incorporation in the lattice, with formation of secondary development centres. L. J. J.

Solid catalysts and reaction rates. O. A. Hougen and K. M. Watson (*Ind. Eng. Chem.*, 1943, 35, 529—541).—It is assumed that reaction at a solid surface is carried out by activated adsorption of reactants. Mathematical reasoning based on this derives a series of rate equations from the rates of adsorption and desorption. The effect of diffusion in the reactant streams is ignored, but allowance is made for changes of concn. in the actual body of the catalyst particle. Methods are suggested for the determination of the consts. in the rate equations. F. RD.

Ignition of methane by hot wires. W. Davies (*Fuel*, 1943, 22, 72—76).—A 10% CH_4 -air mixture could not be ignited by direct transmission of heat from an electrically-heated Au or Pt wire of 0.127 mm. diameter. Ignition was brought about only by the arc formed when the wire fused. Ignition occurred more readily with the Au than with the Pt wire in spite of the higher m.p. of the latter. With Pt catalytic oxidation of the CH_4 begins at ~600° (in itself causing a rise of temp. of the wire) so that when fusion ultimately occurs the gas mixture in the neighbourhood of the wire may be non-inflammable. Au has no catalytic action on the oxidation of CH_4 . Moreover a heavier current is required to fuse a Au wire than a Pt wire of the same diameter so that the arc produced when the former fuses is more powerful. Since the arc is the effective agent producing ignition the nature of the electric circuit employed will affect the results observed. A. B. M.

Catalytic hydrogenation of benzene over metal catalysts. P. H. Emmett and N. Skau (*J. Amer. Chem. Soc.*, 1943, 65, 1029—1035).—Catalytic activity, in the hydrogenation of C_6H_6 below 200°, and the adsorption of CO and CO_2 on Co, Fe-Co, Fe, Cu, Cu-Ni, Ni, Pd, Pd-Ag, and Ag catalysts has been determined. Body-centred cubic Fe catalysts, having a surface area equal to that of the very active Co and Fe-Co catalysts, are not active. Face-centred cubic Cu catalysts are also inactive but addition of small amounts of Ni induces slight activity at 200°. Pd is active, Ag inactive; the activity, per unit of Pd, of Pd-Ag alloys decreases considerably with decreasing Pd content. CO is instantly adsorbed (chemisorption) on reduced Cu and Ni catalysts at -195°; CO_2 at -78° is chemisorbed on Ni but not on Cu. Having crystal structure and lattice dimensions within the Balandin square of activity is a necessary but insufficient criterion for the activity of metal catalysts in the hydrogenation of C_6H_6 below 200°. W. R. A.

Catalytic investigation on alloys. VIII. Properties of copper-nickel alloys in the catalysis of the decomposition of formic acid vapour. G. Rienäcker and H. Bade. IX. Decomposition of formic acid vapour on copper-platinum mixed crystals in relation to composition and ordering of the alloys. G. Rienäcker and H. Hildebrandt (*Z. anorg. Chem.*, 1941, 248, 45—51, 52—64).—VIII. Ni has a high and Cu a low catalytic activity for the decomp. of HCO_2H vapour. Alloys with > 70% Ni resemble Cu, though there is a max. of activity at 18 at.-% Ni. The activation energy rises with increasing % of Ni up to 20 at.-%, remains const. up to 70 at.-%, and then increases again to the val. for pure Ni.

IX. The catalytic activity of Pt for the decomp. of HCO_2H vapour is >> that of Cu. That of the chilled alloys increases steadily with increasing % of Pt. The activation energy decreases with increasing % of Pt up to 44 at.-% and then remains const. The change from disordered to ordered structure in the Cu_3Pt region produces a marked increase in activity and decrease of activation energy. F. J. G.

Catalysis in oxidation of lubricating oil.—See B., 1943, I, 358.

[Catalytic] synthesis of liquid fuels from carbon monoxide and hydrogen.—See B., 1943, I, 357.

[Laboratory] method for producing electrolytic gas. A. F. Williston (*J. Chem. Educ.*, 1943, 20, 210). L. S. T.

Action of light on acetaldehyde vapour. C. W. Woolgar and A. J. Allmand (*Trans. Faraday Soc.*, 1943, 39, 219—225).—In the decomp. of MeCHO vapour by ultra-violet light large quantities of a liquid polymeride, probably paraldehyde, are formed, photolysis of which in the vapour phase at 25° and in Cl_2 -filtered light is negligible. Pressure changes are recorded, and quantum efficiencies for the decomp. and for the polymerisation are given. Analysis of the gaseous products suggests that $COMe_2$ is probably formed simultaneously with the main reaction $MeCHO \rightarrow CH_4 + CO$. F. L. U.

Physico-chemical basis of mitogenetic radiation. Y. I. Frenkel and A. G. Gurvich (*Trans. Faraday Soc.*, 1943, 39, 201—204).—In the scission of peptides by peptidase, of $CO(NH_2)_2$ by urease, and of glucose by zymase, mitogenetic radiation occurs only in presence of O_2 , and in the first two systems under the action of visible light. Assuming that the radiation is due to recombination of radicals, the wave-length of light required to promote it is calc. on the basis of available thermal data. The results [λ 5000 Å. for glycylglycine, 4800 Å. for $CO(NH_2)_2$] are confirmed by experiment. For radiation accompanying glucolysis no external source of energy should be needed, and this is in accord with the observation that the glucose-zymase system radiates in the dark. F. L. U.

Effect of intense sonic waves on molten metals. III. Dissolution of iron in molten zinc. G. Schmid and A. Roll (*Z. Elektrochem.*, 1940, 46, 653—657).—Zn was melted in Fe crucibles, and the rate at which the Fe dissolved was determined by chemical analysis and microscopical examination. > 1% of iron was taken up in a short time. The rate of dissolution of the Fe was greatly increased by the sonic waves; they also did not favour dendritic growth, and caused a reduction in grain size on solidification. R. KE.

IX.—PREPARATION OF INORGANIC SUBSTANCES.

New type of complex silver compounds with tervalent silver. P. Rây (*Nature*, 1943, 151, 643).—The compounds $[Ag^{III}(endigh)_3]X_3$ ($endigh = ethylenediguanide$; $X = SO_4, NO_3, ClO_4, OH$), red acicular prisms, stable at room temp., diamagnetic, have been prepared. The diamagnetic character accords with the supposition that the co-ordination bonds are of the hybrid $d-s-p^2$ type, as in planar Ni^{II} complexes. A. A. E.

Pyridine complex of metallic perchlorates. I. P. C. Sinha and R. C. Ray (*J. Indian Chem. Soc.*, 1943, 20, 32—36).—The following complexes are described ($X = C_5H_5N$): $AgClO_4 \cdot 4X$; $Cu(ClO_4)_2 \cdot 4X$; $Mg(ClO_4)_2 \cdot 6X$; $Ca(ClO_4)_2 \cdot 6X$; $Sr(ClO_4)_2 \cdot 6X$; $Ba(ClO_4)_2 \cdot 6X$; $Zn(ClO_4)_2 \cdot 4X$; $Cd(ClO_4)_2 \cdot 6X$; $Hg(ClO_4)_2 \cdot 6X$; $Mn(ClO_4)_2 \cdot 8X$; $Ni(ClO_4)_2 \cdot 6X$; $Co(ClO_4)_2 \cdot 6X$. J. H. BA.

Hydration of calcium aluminates. IV. Hydrothermal reactions of tricalcium aluminate and its hydrates. G. M. Harris, W. G. Schneider, and T. Thorvaldson (*Canad. J. Res.*, 1943, 21, B, 51—72).—Homogeneous samples of $3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{H}_2\text{O}$ (I) can be obtained by heating $3\text{CaO} \cdot \text{Al}_2\text{O}_3$ (II) or its hexagonal hydrate in saturated steam at $>150^\circ$. At $<250^\circ$ and under conditions favouring rapid hydrolysis, crystals of $\text{Ca}(\text{OH})_2$ and a hydroaluminate (III) of $\text{CaO} : \text{Al}_2\text{O}_3$ ratio $<1.5:1$ are formed. (III) forms rectangular elongated prismatic plates of low birefringence and $n\ 1.627$. It is also produced by the action of $\text{Ca}(\text{OH})_2$ on hydrated Al_2O_3 in saturated steam at 350° . Prolonged action of saturated steam on $\text{Ca}(\text{OH})_2$ and (III) at $>150^\circ$ reconverts them into (I). When (II) or its hydrates are heated at $<250^\circ$ under conditions favouring hydrolysis another hydroaluminate which is strongly birefringent, $n\ 1.58$, is formed. The production of these hydroaluminates may explain the effect of hydrothermal treatment at $>150^\circ$ on the tensile and compressive strength of precast Portland cement concrete products. J. W. S.

Volatile borates of polyhydric alcohols and the activation of boric acid.—See A., 1943, II, 290.

Alumina of graded adsorptive powers for chromatographic adsorption. H. Brockmann and H. Schodder (*Ber.*, 1941, 74, [B], 73—78).—Five grades of alumina (Merck) are noted. Full activation is achieved by heating to red heat and cooling in a desiccator and partly deactivated aluminas are obtained when this product is kept, or shaken in moist air. The various grades possess graded adsorptive powers towards 6 dyes (*p*-methoxyazobenzene, azobenzene, Sudan-yellow, Sudan-red, *p*-amino- and -hydroxy-azobenzene), which are passed through columns under standardised conditions. J. W. A.

Synthesis of triphosgene for war gas identification sets. F. C. Hickey and J. J. Hanley (*J. Chem. Educ.*, 1943, 20, 229—230).—Prep. by chlorination of Me_2CO_3 in ultra-violet light is described. L. S. T.

Demonstration of the oxidation of ammonia to nitric acid. S. S. Hauben and R. S. Siegel (*J. Chem. Educ.*, 1943, 20, 166). L. S. T.

Niobium oxides. G. Brauer (*Z. anorg. Chem.*, 1941, 248, 1—31).— Nb_2O_5 , NbO_2 , and NbO are the only Nb oxides. Nb_2O_5 exists in three modifications, one of which is isomorphous with Ta_2O_5 . Its m.p. is $1460^\circ \pm 5^\circ$. The structure of NbO is closely related to that of rutile, with $a\ 4.84$, $c\ 2.99\ \text{\AA}$, $c/a = 0.618$. NbO is cubic with $a\ 4.202\ \text{\AA}$. At. positions and a diagram of the structure are given. $\rho_4^0 = 7.30$. The solubility of O_2 in Nb is $>5\ \text{at.-%}$. F. J. G.

Basic bismuth permanganates. F. Hein and H. Holzapfel (*Z. anorg. Chem.*, 1941, 248, 77—83).—Basic Bi permanganates, $[\text{Bi}_2\text{O}_2(\text{OH})]\text{MnO}_4 \cdot 1.5\text{H}_2\text{O}$ and $[\text{Bi}_3\text{O}_3(\text{OH})_2]\text{MnO}_4$, are described. F. J. G.

Mechanism of chemical reactions with heavy oxygen. A. E. Brodsky, N. I. Dedussenko, I. A. Makolkin, and G. P. Miklukhin (*J. Chem. Physics*, 1943, 11, 342).—(i) In the Beckmann rearrangement of $\text{CPh}_2\text{N} \cdot \text{OH}$ in presence of PCl_5 and H_2^{18}O , the O of the oxime is entirely replaced by ^{18}O , indicating intermediary dehydration and hydration steps, but not direct intramol. transfer. (ii) Et^{18}OH and Ac_2^{18}O give $\text{MeC}^{18}\text{O}^{18}\text{OEt}$. (iii) Na^{18}OH fusion of Na salts of PhSO_3H , $2\text{-C}_{10}\text{H}_7\text{SO}_3\text{H}$, and anthraquinone-2-sulphonic acid gives R^{18}ONa , indicating elimination of SO_3Na and addition of ONa . (iv) In the xanthation of EtOH and alkali cellulose with Na^{18}OH , the ^{18}O passes into the H_2O formed. L. J. J.

Preparation of phosphomolybdic acid from phosphoric acid and pure molybdic acid. A. Linz (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 459).—Details for the prep. of phosphomolybdic acid from MoO_3 and 85% H_3PO_4 are given. The method is applicable to the prep. of phosphotungstic acid by substituting WO_3 for MoO_3 . L. S. T.

Effect of heating γ -iron hydroxide, cadmium carbonate, and stoichiometric mixtures thereof. I. W. Schröder (*Z. Elektrochem.*, 1940, 46, 680—697).—The formation of Cd-Fe spinel was studied, the methods used being (1) loss of wt. on slow heating, (2) vol. and composition of evolved gases, (3) observation of colour changes, (4) X-ray examination of reaction products, and (5) measurement of the emanation after the reactants had been treated with radio-Th. $\gamma\text{-FeO} \cdot \text{OH}$ begins to lose H_2O at 150° , and is converted into $\gamma\text{-Fe}_2\text{O}_3$ at 250° ; above 350° $\alpha\text{-Fe}_2\text{O}_3$ is formed, the change being complete at 450° . CdCO_3 when heated lost CO_2 , the dissociation temp. ($p_{\text{CO}_2} = 1\ \text{atm.}$) being 357° . Above 800° the CdO began to decompose, Cd vapour being evolved. When mixtures of the two substances were heated, they began to react at 500° , but no spinel lines were found in the X-ray examinations below 730° . At 800° spinel formation was complete, and above 900° decomp. commenced, Cd vapour being evolved. R. KE.

Reactions of organometallic compounds with iron pentacarbonyl and iron carbonyl hydride. F. Hein and H. Poblath (*Z. anorg. Chem.*, 1941, 248, 84—104).— $\text{Fe}(\text{CO})_5$ and $\text{H}_2\text{Fe}(\text{CO})_4$ react with organometallic compounds, probably forming mixed organometallic carbonyls, which then undergo further reactions. With organo-Hg compounds the final products are $\text{HgFe}(\text{CO})_4$ and ketones. $\text{H}_2\text{Fe}(\text{CO})_4$ and organo-metallic bases afford organo-metallic carbonyls. $\text{Et}_2\text{PbFe}(\text{CO})_4$ is described. F. J. G.

Complex compounds: their derivation and nomenclature. O. J. Stewart (*J. Chem. Educ.*, 1943, 20, 230—231; cf. A., 1941, I, 277).—New names for $\text{K}_3\text{Fe}(\text{CN})_6$, $\text{K}_4\text{Fe}(\text{CN})_6$, $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$, $\text{Na}_2\text{S}_2\text{O}_3$, $\text{K}_2\text{Cr}_2\text{O}_7$, KI_3 , and $(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3$ are discussed. L. S. T.

Demonstration of some properties of Prussian-blue. M. Kohn (*J. Chem. Educ.*, 1943, 20, 198).—Reduction to $\text{Fe}_2\text{Fe}(\text{CN})_6$ and reaction with aq. $\text{K}_2\text{C}_2\text{O}_4$ are described. L. S. T.

Reversible chromatic thermosensitivity. E. W. Blank (*J. Chem. Educ.*, 1943, 20, 171—174).—The changes in colour shown by numerous substances on heating are tabulated and discussed. Data for several ferri- and ferro-cyanides are recorded. L. S. T.

Isomerism of ruthenium trichloride hydrates. G. Grube and G. Fromm (*Z. Elektrochem.*, 1940, 46, 661—667).— RuCl_3 , free from RuCl_2 and RuCl_4 , was prepared. Dil. HCl was used as solvent throughout, to prevent hydrolysis of the RuCl_3 . The isomerism was investigated by means of electrical conductivity measurements and potentiometric titrations with AgNO_3 . A freshly prepared solution in 0.1N-HCl contained \leq one Cl^- per Ru atom; on keeping at 50° $[\text{Cl}^-]$ increased to one Cl^- per Ru atom, the colour changing from blue-green to emerald-green. Further keeping, or heating at 80° , produced little change, but the solution turned yellow-brown. Similar changes took place in 0.5N-HCl . The changes are said to be $[\text{RuCl}_3\text{H}_2\text{O}]$ (blue-green) $\rightarrow [\text{RuCl}_2(\text{H}_2\text{O})_2]\text{Cl}$ *cis*-isomeride (emerald-green) \rightarrow *trans*-isomeride (yellow-brown). R. KE.

Complex compounds of diguanide with bivalent metals. IV. Palladium diguanidine and its salts. P. Ray and S. P. Ghose (*J. Indian Chem. Soc.*, 1943, 20, 19—21).—Palladium diguanidine, $\text{Pd}(\text{C}_2\text{H}_5\text{N}_3)_2$, forms compounds $[\text{Pd}(\text{C}_2\text{H}_5\text{N}_3)_2]\text{X}$, where $\text{X} = (\text{OH})_2$, Cl_2 ($2\text{H}_2\text{O}$), Br_2 (H_2O), I_2 ($2\text{H}_2\text{O}$), SO_4 ($3\text{H}_2\text{O}$), S_2O_3 ($3\text{H}_2\text{O}$), $(\text{NO}_3)_2$, $(\text{CNS})_2$ (H_2O), $\text{Pd}(\text{CNS})_4$, PtCl_6 ($5\text{H}_2\text{O}$). The Pd complex is more stable than the corresponding Ni complex. J. H. BA.

X.—ANALYSIS.

Sensitivity of chemical reactions. I. A. Schleicher (*Z. anal. Chem.*, 1941, 121, 86—90).—Current methods of expressing the sensitivity of a reaction are critically discussed. It is proposed to express the qual. sensitivity of a reaction as a detection sensitivity by means of the limiting dilution and not by a limiting concn.; sensitivity then becomes vol. in c.c. per μg . L. S. T.

Correction of a computation formula in Bunsen's "Gasometric Methods." H. Koelsch (*Z. anal. Chem.*, 1941, 121, 84—86). L. S. T.

Semi-micro scheme of qualitative analysis for the anions. J. T. Dobbins and M. E. Kapp (*J. Chem. Educ.*, 1943, 20, 118—120).—Details are given for separating anions into the following groups: (i) ions pptd. as Ca salts from alkaline solution, viz., CO_3^{2-} , F^- , $\text{C}_2\text{O}_4^{2-}$, tartrate, SO_3^{2-} , AsO_4^{3-} , AsO_3^{3-} , and PO_4^{3-} ; (ii) ions pptd. as Ba salts from alkaline solution, viz., SO_4^{2-} and CrO_4^{2-} ; (iii) ions pptd. as Cd salts from alkaline solution, viz., S^{2-} , $\text{Fe}(\text{CN})_6^{4-}$, BO_3^{3-} , and $\text{Fe}(\text{CN})_6^{3-}$; (iv) ions pptd. as Ag salts from a solution just acid with HNO_3 , viz., CN^- , CNS^- , $\text{S}_2\text{O}_3^{2-}$, Cl^- , Br^- , and I^- ; (v) the ions OAc^- , ClO_3^- , NO_3^- , and NO_2^- . Additional separations in each group and identification of individual ions are described. L. S. T.

Determination of hydrogen-ion concentration with tungsten and molybdenum electrodes. H. Brintzinger and B. Rost (*Z. anal. Chem.*, 1940, 120, 161—165).—W and Mo electrodes are preferred to the Sb electrode. Comparative vals. for buffered solutions of known pH and for other solutions obtained with W, Mo, and H₂ electrodes or colorimetrically are given. F. N.

Estimation of high chlorine residuals [in water].—See B., 1943, III, 228.

Volumetric determination of bromide in brines.—See B., 1943, I, 366.

Volumetric determination of fluorine by means of zirconium-alizarin lake. F. Nölke (*Z. anal. Chem.*, 1941, 121, 81—84).—The test solution ($>50\ \text{c.c.}$) is neutralised with aq. NH_3 , acidified with $10\ \text{c.c.}$ of glacial AcOH , and diluted accurately to $100\ \text{c.c.}$ $10\ \text{c.c.}$ of Zr-alizarin solution (prep. described) and $5\ \text{c.c.}$ of $\text{C}_6\text{H}_{11}\text{OH}$ are diluted to $20\ \text{c.c.}$ and titrated with the diluted test solution until, after thorough shaking of the whole solution, the $\text{C}_6\text{H}_{11}\text{OH}$ layer just becomes yellow. A specially-prepared comparison solution facilitates the detection of the end-point. The method is accurate, and is suitable for both simple and complex fluorides. L. S. T.

Determination of fluorine in aluminium oxide containing cryolite.—See B., 1943, I, 367.

Determination of dissolved oxygen in water by Winkler's method without using potassium iodide.—See B., 1943, III, 228.

Analysis of oxygen and carbon dioxide resuscitation mixtures.—See B., 1943, I, 367.

Dead-stop end-point as applied to the Karl Fischer method for determining moisture.—See B., 1943, II, 269.

New possibility of error in the determination of sulphur as barium sulphate. A. Schleicher (*Z. anal. Chem.*, 1941, 121, 90—92).—

BaCl₂ is absorbed from the mother-liquor by the filter-paper, and is not completely removed even by abundant washing with hot H₂O. This error is avoided when the filter-paper is given a preliminary rinsing with moderately conc. HCl. L. S. T.

Automatic apparatus for determination of small concentrations of sulphur dioxide in air. Application to hydrogen sulphide, mercaptan, and other sulphur and chlorine compounds.—See B., 1943, III, 226.

Titration with alkaline permanganate solution. IV. Volumetric determination of quadrivalent selenium with permanganate. H. Stamm and M. Goehring (*Z. anal. Chem.*, 1940, 120, 230—232).—Se (40—120 mg.) as SeO₃'' is added to 50 c.c. of 0.1N-KMnO₄ + 25 c.c. of 23—25% aq. NaOH; after 15 min. H₂O, H₂SO₄, H₂C₂O₄ (~0.25 M.), and MnSO₄ are added in that order. The solution is then titrated at 50° with KMnO₄, and a blank determination is performed in absence of Se. Vals. ±0.2 mg. were obtained. HNO₃ does not interfere; HNO₂ or N oxides are removed with air. F. N.

Determination of small amounts of tellurium in high-lead and tin-base alloys.—See B., 1943, I, 376.

Anhydrous copper sulphate in the Kjeldahl nitrogen determination. C. Beatty, 3rd (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 476).—The use of anhyd. CuSO₄ instead of CuSO₄·5H₂O prevents bumping and permits a smoother and quicker digestion. L. S. T.

Formaldehyde method of determining ammonia-nitrogen in fertilisers.—See B., 1943, III, 199.

Determination of nitrogen in slags produced during electro-melting [of metals].—See B., 1943, I, 378.

Determination of phosphorus by molybdenum-blue method. W. I. M. Holman (*Biochem. J.*, 1943, 37, 256—259).—The method, which involves use of KI as reducing agent, is described. The blue colour produced is stable at 12—32° for 24 hr., and 1—100 µg. of P can be determined with ±2% error if a photoelectric absorptiometer is used. The blue colour closely obeys Beer's law, and a correction is applied for a faint colour in the control when a visual colorimeter is used. > traces of Cu'' should be present. As and Si also produce blue colours, and the max. amounts which can be present without affecting the test are 1 µg. of As for Na₃AsO₄ and 10 µg. of SiO₂ for water-glass. The method is suitable for HCl extracts of residues formed by ashing or fusion with Na₂CO₃. It cannot be used to distinguish between org. and inorg. P, and several org. P compounds are hydrolysed under the conditions of the determination. J. N. A.

Colorimetric determination of phosphorus.—See B., 1943, III, 199.

Photoelectric determination of phosphorus in plain carbon steels.—See B., 1943, I, 376.

Volatility of potassium or sodium sulphate in the gravimetric determination of potassium or sodium as K₂SO₄ or Na₂SO₄. N. Kolarow (*Z. anal. Chem.*, 1941, 122, 399—404).—The literature technique of treating the H sulphates or pyrosulphates with (NH₄)₂CO₃ and heating to only moderate temp. is unnecessary. Complete decomp. of KHSO₄ or K₂S₂O₇ to K₂SO₄ at 670° requires 7 hr.; pretreatment once with (NH₄)₂CO₃ (to const. wt. at 120°) reduces this to 6 hr., three times to 5 hr. Na₂SO₄, K₂SO₄, and mixtures thereof do not lose wt. in the gas flame, or in the electric oven below 1040°, whether the Pt crucible is covered or not. For determinations, heating at red heat for 5—7 min. suffices, but there is no danger of loss even in ½ hr. S. A. M.

Determination of caustic alkali and carbonate in the zinc cyanide bath.—See B., 1943, I, 376.

Polarographic analysis of calc spar. M. Straumanis and A. Dravnieks (*Z. anal. Chem.*, 1940, 120, 168—177).—Small amounts (<0.001%) of Pb, Zn, and Mn can be determined with an accuracy of 5% by using the apparatus of Heyrovsky and Shikata (*A.*, 1925, ii, 674). F. N.

Electrolytic determination of zinc at brass electrodes. I. Separation of zinc from a solution buffered with sodium acetate. M. Karschulin and S. Ban. **II. Separation of zinc from copper from a buffered solution.** M. Karschulin and M. Mirnik (*Z. anal. Chem.*, 1940, 120, 244—247, 248—252).—I. At brass cathodes the deposition potential of Zn is -0.820 v. and is independent of pH; at Zn cathodes it increases with increasing pH. At pH 6 separation at brass cathodes is satisfactory; at pH <6 it is not quant.

II. Cu is completely removed by electrolysis in dil. H₂SO₄ solution; the electrolyte is then conc., neutralised, brought to pH 6—6.5 with NaOAc, and electrolysed for Zn. F. N.

Determination of zinc in aluminium and its alloys.—See B., 1943, I, 378.

Determination of zinc and cadmium in yellow glasses.—See B., 1943, I, 370.

Use of cadmium tetrapyridine thiocyanate in gravimetry. G. Vornweg (*Z. anal. Chem.*, 1940, 120, 243).—When NH₄CNS is added to a neutral Cd solution and heated with a large excess of C₆H₅N a ppt. of [Cd(C₆H₅N)₄(CNS)₂] is obtained (cf. Spacu and Dick, *A.*, 1928, 499). After cooling the ppt. is collected and dried for 20

min. in a vac. desiccator. It is insol. in C₆H₅N and contains 20.63% Cd. F. N.

Determination of lead by the chromate method. F. Grote (*Z. anal. Chem.*, 1941, 122, 395—398).—2 equivs. of 0.5N-K₂Cr₂O₇ in AcOH is added to boiling Pb(OAc)₂ in AcOH, boiled for 10 min., and filtered after 2 hr.; the ppt. is washed with hot distilled H₂O, and dried for 1 hr. at 105° and 2 hr. at 160°. CrO₄'' is held by the ppt. The empirical factor is 0.6378 (±0.0005); agreement with the sulphate method is then obtained (to ±0.05%). S. A. M.

Analysis of lead [accumulator] paste.—See B., 1943, I, 350.

Quinaldinic acid as a reagent for the separation of copper and cadmium. A. K. Majumdar (*Analyst*, 1943, 68, 242—244; cf. *A.*, 1940, I, 81).—A reply to criticisms by Lindsay and Shennan (*A.*, 1941, I, 57). S. B.

Separation of copper and cadmium by means of quinaldinic acid. C. F. Pritchard and R. C. Chirnside (*Analyst*, 1943, 68, 244).—The results given by Majumdar (preceding abstract) are confirmed. X-Ray and chemical examination indicate that no co-pptn. of Cd with Cu occurs. S. B.

Substituted amides of dithiocarbonic acid as reagents for Cu'' ions. E. Geiger and H. G. Müller (*Helv. Chim. Acta*, 1943, 26, 996—1003).—With NRR'CS₂H Cu'' forms coloured salts which give yellow-brown solutions. The salts are formed immediately and in true solutions which are stable. For the detection of Cu'' in aq. solutions an alcoholic solution of diethanolamine NN-di-β-hydroxyethyl-carbamate is used. Cu NN-diisooamyl- and NN-diethyl-dithiocarbamate can be removed from aq. solution by CCl₄. Cu NN-di-β-hydroxyethyl-dithiocarbamate decomposes at 169°. H. W.

Copper content of sea-water. P. S. Galtsoff (*Ecology*, 1943, 24, 263—265).—NET₂·CS₂Na is the most sensitive reagent for Cu but the [Cu] in sea-H₂O is < the concn. which permits an accurate determination. The use of a photometer does not greatly increase the accuracy because of the high corrections that have to be employed. In the localities studied the Cu content of sea-H₂O was rarely >0.02 mg. per l. L. G. G. W.

Rapid photometric determination of copper in ferrous [alloy] materials.—See B., 1943, I, 376.

Rapid volumetric determination of copper in presence of much tin and of iron and tin.—See B., 1943, I, 376.

Determination of small amounts of aluminium in water by means of hæmatoxylin.—See B., 1943, III, 228.

Spectrochemical procedure in clay analysis.—See B., 1943, I, 370.

Identification of rust on iron and steel. R. O. Clark (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 464—465).—Gelatin paper (prep. from photographic paper described) moistened with H₂O will remove sufficient rust for identification purposes without affecting the metal. The paper is pressed against the specimen, removed, and the pattern of the rusted surface developed by immersion in 10% HCl containing 0.05% of K₄Fe(CN)₆. Sulphide films from Cu or Pb are not removed by this treatment. L. S. T.

Microscopical identification of ferrous sulphate in mixtures. G. L. Keenan and W. V. Eisenberg (*J. Assoc. Off. Agric. Chem.*, 1943, 26, 256—257).—Partly dried crystals are detected by the min. and max. *n* (1.525, 1.539) of fragments showing max. double refraction with crossed nicols. After recrystallisation from a drop of H₂O the FeSO₄·7H₂O has *n*_a 1.471, *n*_β 1.478, *n*_γ 1.486. A. A. E.

Use of perchloric acid in analysis of alloys of the iron group.—See B., 1943, I, 376.

Determination of nickel salts by means of the Zeiss dipping refractometer. P. Csokán (*Z. anal. Chem.*, 1941, 121, 29—38).—Data relating refraction to concn. are tabulated for 0.1—1.2M. solutions of NiCl₂·6H₂O and Ni(NO₃)₂·6H₂O at 17.5°. Temp. corrections for the range 0—30° are also recorded. L. S. T.

Determination of small amounts of molybdenum in tungsten and molybdenum ores.—See B., 1943, I, 378.

Analysis of tungsten carbide tips.—See B., 1943, I, 378.

Determination of quadrivalent tin. E. Eegriwe (*Z. anal. Chem.*, 1940, 120, 81—84).—1 drop of 1:2:7-trihydroxyanthraquinone in MeOH (0.1 g. in 100 c.c.) is added to 1 drop of the Sn solution in HCl (yellow colour), then dropwise 7.5% aq. (NH₄)₂CO₃ until basic (red colour), followed by AcOH (33 vol.-%) until acid (orange to orange-red colour or ppt.). 0.2 µg. Sn in 1 drop of solution can be detected. F. N.

α-Picoline methiodide as a reagent for bismuth. K. Whelan and F. J. Welcher (*J. Chem. Educ.*, 1943, 20, 246—248).—Aq. α-picoline methiodide (prep. described) gives an orange colour or ppt. with Bi''' (limit of identification 0.002 mg. per ml., or 0.4 µg. per drop). Ag' and Hg₂'' must be removed by HCl; Cu'', Fe'', and other oxidising substances interfere by liberating I, and must be removed. Small amounts of Pb, Hg'', Ag, and Sn'' do not interfere, but large amounts must be removed by the usual group procedure. L. S. T.

Detection of gold in plating.—See B., 1943, I, 377.

XI.—APPARATUS ETC.

Theory of the electric arc furnace. II. P. Drossbach (*Z. Elektrochem.*, 1940, 46, 668—669; cf. A., 1943, I, 238).—The theory is extended to make allowance for superheating of the melt. R. Kē.

Vapour thermoregular [for accurate temperature control of small, insulated rooms]. J. Y. Yee (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 462—463). L. S. T.

Simple method of demonstrating the decrease of specific heat of a solid at low temperatures. F. H. Müller (*Physikal. Z.*, 1940, 41, 296—297).—A Ni disc attached to a thermo-element is placed inside a Dewar flask and light from an arc lamp is focussed on it. Liquid air is then poured into the vessel, and the time for which the disc must be illuminated for the galvanometer to indicate the same swing as when the vessel was empty is determined. A. J. M.

Actinic value of light sources. H. Korte and W. Meidinger (*Physikal. Z.*, 1940, 41, 305—307).—Comparisons of the actinic val. of a DIN light source, a Nitra-lamp, and a Hg-vapour lamp have been made. A. J. M.

Use of a rotation-dispersion stationary filter. F. Gabler (*Physikal. Z.*, 1940, 41, 339—341).—The use of such a filter for investigating double refraction or optical and magnetic rotations is described. A. J. M.

Refractive power of absorbing liquids. H. Littmann (*Physikal. Z.*, 1940, 41, 442—447).—Methods of determining n for absorbing liquids are discussed. A. J. M.

Fibre refractometer.—See B., 1943, II, 281.

Applications of near infra-red spectrophotometry.—See B., 1943, II, 302.

Measurement of anomalous dispersion in opaque dielectrics. A. W. Lawson (*Rev. Sci. Instr.*, 1943, 14, 38—43).—A method for measuring n of opaque materials as a function of λ is based on the determination of Brewster's angle of reflexion of polarised light from a polished surface. J. L. E.

Measurement of angular domains of reflexion in polycrystalline samples. A. Reis (*Amer. Min.*, 1942, 27, 231).—An outline of the method used is given. Systematic study of imperfections in crystal structure can be made. L. S. T.

Briquetting press and electrode loader for spectrochemical analysis. H. C. Harrison and C. C. Ralph (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 466—467). L. S. T.

Improved salt bridge for polarographic and potentiometric measurements. D. N. Hume and W. E. Harris (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 465).—The calomel electrode is connected to the cell by ordinary rubber tubing filled with saturated KCl. The tubing ends with a short length of glass tubing filled with 3% agar gel saturated with KCl. L. S. T.

Electrometric apparatus for use with the Karl Fischer method for determination of water. C. D. McKinney, jun., and R. T. Hall (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 460—462). L. S. T.

Electrophoresis of colloids under war-time conditions. K. G. Stern (*Rev. Sci. Instr.*, 1943, 14, 187).—A summary of simplified technique, the use of substitutes, and extended applications of the Tiselius type apparatus. N. M. B.

Voltage stabiliser for electron diffraction power supply. S. H. Bauer, J. M. Hastings, and D. P. MacMillan (*Rev. Sci. Instr.*, 1943, 14, 30—32).—The circuit and performance characteristics of a simple degenerative type high-voltage stabiliser in which the regulator is inserted in the positive side of the high-voltage line is described, the design being particularly applicable to electron diffraction power supplies. J. L. E.

Measuring small electric charges. R. M. Showers (*Rev. Sci. Instr.*, 1943, 14, 35—37).—An apparatus consisting of two ionisation chambers, an electrometer tube the grid of which is disconnected during the X-ray exposure, and a specially designed shielded switch has been constructed for measuring electric charges $\sim 1.5 \times 10^{-11}$ coulomb with an accuracy of $\pm 1\%$. It is designed to measure the ionisation produced in air by roentgenographic apparatus. J. L. E.

Improved cosmic-ray radio sonde. W. H. Pickering (*Rev. Sci. Instr.*, 1943, 14, 171—173).—The instrument described embodies a new means of modulating the transmitter, a new receiver, and a new recorder, enabling the scaling down of the cosmic-ray counts to be done at the ground station instead of at the transmitter. N. M. B.

New switching device for a counter worked by a thyatron. J. Schintlmeister and W. Czulijs (*Physikal. Z.*, 1940, 41, 269—271).—A circuit for switching out the thyatron in a counter apparatus is given. A. J. M.

Synchronised calibrator for sweep and gain in cathode-ray recording. S. A. Talbot (*Rev. Sci. Instr.*, 1943, 14, 184—186).—The circuit comprises an oscillator and multivibrator generating three timing

scales suited to calibrate a wide range of sweep speeds. A square pulse with adjustable duration is provided to calibrate the gain and to record the frequency characteristics of an amplifier. Both calibrations are synchronised with the sweep. N. M. B.

Electrodynamic determination of the magnetic moment of plates. E. T. Benedikt (*Rev. Sci. Instr.*, 1943, 14, 43—45). J. L. E.

Gas burette with mechanical reduction of the gas volume to normal conditions. R. Thilenius (*Z. anal. Chem.*, 1941, 122, 385—395).—The gas is measured, over H_2O , at the same temp. and pressure as that in a compensating vessel containing H_2O and the quantity of air which, if dry, would exert 760 mm. at 0° . S. A. M.

Theory of chromatography. J. Weiss (*J.C.S.*, 1943, 297—303).—The theory of the formation of the chromatogram in a column of an adsorbent from a single substance and the process of development is discussed for several adsorption isotherms (linear, Langmuir, and Freundlich). The theory assumes practically instantaneous equilibrium between solution and adsorbent, but non-equilibrium conditions are also mentioned. The structure and shape of the band are discussed. A. J. M.

Experimental study of chromatography. H. Weil-Malherbe (*J.C.S.*, 1943, 303—312).—A quant. investigation of the phenomena associated with chromatography has been made for the simplest type of system, where there is one adsorbent (SiO_2 gel or Al_2O_3), one adsorptive (usually benzpyrene), and one solvent. The vol. of adsorptive in the filtrate was plotted against the total vol. of filtrate. The shape of the elution curve thus obtained is discussed. It is sigmoid in form, and its shape depends on the adsorbent used. It also depends on the exponential coeff. α of the Freundlich adsorption isotherm. If α is ~ 1 , the curve is approx. symmetrical, but if α is < 1 , it shows a tail. The shape of the adsorption column has some effect, but it is not crit. The mean concn. of the eluate is $\propto 1/V_t$ (V_t = "threshold vol.," the vol. of filtrate collected up to the beginning of elution). The variation of V_t with vol. and concn. of the original solution and the quantity of adsorbent was studied. The results are discussed in relation to the theory of Weiss (see preceding abstract). A. J. M.

Recommended specifications for microchemical apparatus. Correction in the design of the Dumas nitrogen stopcock. G. L. Royer, H. K. Alber, L. T. Hallett, and J. A. Kuck (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 476; cf. A., 1941, II, 385). L. S. T.

Simple micro-filtration apparatus. A. G. Howkins (*Chem. and Ind.*, 1943, 291).—The apparatus described is a boiling tube with a constriction near the open end which is opened out to form a funnel into which is ground a filter-funnel and a side-arm sealed on below the constriction. F. R. G.

Glass laboratory pump for gases or liquids. W. T. Olson and R. A. Spurr (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 467).—The pump delivers gas at 250 ml. per min. against a head of 1 cm. of Hg; the limiting head for gas is 25 cm. of Hg. L. S. T.

Spot plate for drop tests. P. W. West (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 475).—Half of the white depressions are glazed black to permit examination of ppts. and coloured solutions. L. S. T.

Delivery of liquids at low and constant rates. E. C. Page, jun., and J. C. Whitwell (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 435—437).—Apparatus for the delivery of small batches of fluid at low and const. rates is presented. An equation useful in designing a unit of proper size for any desired installation is given. L. S. T.

Viscometers.—See B., 1943, I, 349.

Apparatus for automatic determination of cadmium in the bath electrolyte of zinc plants.—See B., 1943, I, 377.

Apparatus for storage and use of carbonate-free alkalis. B. S. Van Zile, R. H. Moulton, and E. W. Blank (*Oil and Soap*, 1943, 20, 122).— CO_2 -free alkali is siphoned into a bottle swept free from CO_2 by air drawn over ascarite. The tip of a burette, similarly swept, is inserted in the rubber collar of the filling tube, and filled in the usual way. E. L.

Easily-constructed precision m.p. apparatus [and valve for regulating the flame of a micro-burner]. E. O. Holmes, jun. (*J. Chem. Educ.*, 1943, 20, 239—240). L. S. T.

Hydrogen sulphide generator (Kipp principle). C. J. Heimerzheim (*J. Chem. Educ.*, 1943, 20, 136). L. S. T.

Portable gas generator. R. Sutcliffe (*Chem. and Ind.*, 1943, 310).—A modified small-type Kipp apparatus is described. S. M.

Method of increasing the sensitivity of Bourdon gauges. S. Barnartt and J. B. Ferguson (*Rev. Sci. Instr.*, 1943, 14, 46—47).—The sensitivity of concavo-convex Bourdon gauges has been increased by a factor of 545 by using an optical lever system, thus enabling direct pressure measurements to the nearest 0.005 mm. of Hg to be made. J. L. E.

Ring method for measuring elastic moduli. A. King (*Rev. Sci. Instr.*, 1943, 14, 33—34).—The mathematical theory of the ring method for measuring shear moduli of wire specimens is presented,

experimental results obtained for Cu and Mo wires agreeing with those obtained by the torsion pendulum method. J. L. E.

Cutting wide-bore glass tubing and glass bottles. A. G. Lipscomb (*Chem. and Ind.*, 1943, 303).—Friction by a loop of string around the glass is applied until the string scorches, H_2O is at once poured over the hot point, and a clean fracture is obtained. N. M. B.

Indicator for the level of liquids. A. D. Power (*Rev. Sci. Instr.*, 1943, 14, 188).—For liquid surfaces which cannot be observed visually (e.g., liquid air) the movement of coloured oil in a U at the top of a vertical glass tube can be used. An alternative method depends on the change of resistance with temp. of a fine wire coil connected to a lamp and cell; the lamp glow indicates contact of the coil and liquid surface. N. M. B.

Liquid flow at small constant rates. R. O. King and R. R. Davidson (*Canad. J. Res.* 1943, 21, A, 65—67).—Two forms of apparatus are described whereby a very small const. flow of liquid is maintained by the pressure of gas produced by electrolysis of $Ba(OH)_2$ at const. temp. A. Li.

Automatic recording devices used in medical research. J. Gorrell (*Trans. Electrochem. Soc.*, 1943, 83, Preprint 22, 253—258).—The monodrum and the dualdrum are described in detail. A stylus attached to a lever and actuated by changes in liquid level, pressure, etc. automatically records the changes on a moving strip of paper. The speed of the paper can be varied over a wide range. The suitability of types of stylus and paper is discussed. C. E. H.

[Apparatus for] laboratory hot air blast. R. E. Dunbar (*J. Chem. Educ.*, 1943, 20, 130). L. S. T.

Improved Kundt's tube. M. B. Reynolds (*J. Chem. Educ.*, 1943, 20, 121—122).—An electrical set-up is described. L. S. T.

Molecular still of new design. F. W. Quackenbush and H. Steenbock (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 468—470).—Construction and performance of a glass-surfaced cyclic still for use in purifying large or small quantities of material are described. L. S. T.

Vacuum distillation equipment for volatile solids. L. Bolstad and R. E. Dunbar (*Ind. Eng. Chem., [Anal.]*, 1943, 15, 464). L. S. T.

Vacuum sublimation and molecular distillation apparatus. B. Riegel, J. Beiswanger, and G. Lanzl (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 417—421).—The mol. distillation and vac. sublimation apparatus described for laboratory use consists of a manifold maintained at 10^{-6} mm. and an auxiliary degassing line. The manifold is equipped with openings of different sizes for use with different stills the design of some of which is described. L. S. T.

Vacuum sublimation. M. H. Hubacher (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 448—450).—Apparatus for sublimation on a macro-scale, and its application to the separation of pharmaceutical products and the determination of the rates of sublimation of numerous org. substances, are described. L. S. T.

Nomograph for the estimation of the activation energies of uni-molecular reactions. E. Warwick (*J. Chem. Educ.*, 1943, 20, 134—135). L. S. T.

Graphical method of calculating pH in acid, base, and salt solutions. H. Flood (*Z. Elektrochem.*, 1940, 46, 669—576).—A graphical method of calculating pH, applicable to acids, bases, salts, amphoteric electrolytes, and buffer solutions, is described. Examples given are aq. NH_3 , H_2CO_3 , NH_4HCO_3 , $(NH_4)_2CO_3$, and $AcOH-OAc'$ buffer solutions. R. KE.

XIII.—GEOCHEMISTRY.

X-Ray study of diamonds artificially prepared by J. B. Hannay in 1880. F. A. Bannister and (Mrs.) K. Lonsdale (*Min. Mag.*, 1943, 26, 315—324).—The minute ($\frac{1}{2}$ mm.) crystals of diamond prepared by Hannay (A., 1880, 707; 1881, 1019; 1882, 218) were identified by Story-Maskelyne (*Chem. News*, 1880, 41, 97; *Nature*, 1880, 22, 404) and this determination is now confirmed by X-ray examination of the original material preserved in the British Museum. One of the 12 fragments proves to be the rare type II with lamellar and mosaic structure of Robertson *et al.* (A., 1934, 583; 1937, I, 166). L. J. S.

Minyulite (hydrous K Al fluophosphate) from South Australia. L. J. Spencer, F. A. Bannister, M. H. Hey, and (Miss) H. Bennett (*Min. Mag.*, 1943, 26, 309—314).—Minute crystals lining cavities in rock phosphate from Noarlunga were determined in 1908 to be orthorhombic and evidently a new mineral. They are now identified with minyulite, described by Simpson and LeMesurier in 1933 from Minyulo Well, Western Australia (A., 1935, 1479), and a new analysis confirms the formula $KAl_2(PO_4)_2(OH,F) \cdot 4H_2O$. Additional data are ρ 2.46, n_α 1.525, n_γ 1.530; the unit cell, a 9.35, b 9.74, c 5.52 Å. ($a:b:c = 0.960:1:0.567$), contains two mols.; space-group C_{2v} . Previous analyses of K Al phosphates are tabulated; some contain $(NH_4)_2O$, indicating val. as plant fertilisers. L. J. S.

Cheviot granite. A. G. Jhingran (*Quart. J. Geol. Soc.*, 1942, 98, 241—254).—The different varieties of granite are described. Modal and chemical analyses and variation diagrams are given. L. S. T.

Graphic granite. W. T. Schaller (*Amer. Min.*, 1942, 27, 233).—In usual specimens from New Hampshire and California, the quartz has been completely removed without any change in the microcline. L. S. T.

The Cnoc nan Cuilean area of the Ben Loyal igneous complex. B. C. King (*Quart. J. Geol. Soc.*, 1942, 98, 147—185).—The rocks, their metasomorphism, rheomorphism, and hybridism are described, and chemical analyses given. L. S. T.

Mutual melting relations of pyroxenoids, melilites, and olivines in the quaternary system $CaO-FeO-Al_2O_3-SiO_2$. J. F. Schairer (*Amer. Min.*, 1942, 27, 233).—Liquidus data for five planes (joins) through a tetrahedron representing this system have been completed. The joins studied are SiO_2 -anorthite (I)- FeO , (I)- Al_2O_3 - FeO , $CaSiO_3$ -(I)- FeO , gehlenite-(I)- FeO , and $CaSiO_3$ -(I)- FeO . The data give the approx. temp. and locations of 11 of the quaternary invariant points. L. S. T.

X-Ray crystallography of burkeite, $2Na_2SO_4 \cdot Na_2CO_3$. L. S. Ramsdell (*Amer. Min.*, 1942, 27, 230—231).—Rotation and Weissenberg photographs of single crystals of synthetic burkeite indicate an orthorhombic cell with a_0 5.16, b_0 9.21, and c_0 7.05 Å. The cell indicated, viz., $\frac{4}{3}(2Na_2SO_4 \cdot Na_2CO_3)$, is only a pseudo-cell; the true unit cell probably has 12 formula wts. L. S. T.

Structural relations between high- and low-chalcocite. M. J. Buerger and N. W. Buerger (*Amer. Min.*, 1942, 27, 216—217).—Investigation of Bristol chalcocite by the equi-inclination Weissenberg technique at 112° gives a_0 3.89, c_0 6.68 Å.; probable space-group $C6/mmc$, with $2Cu_2S$ in the unit cell. A structure composed of S atoms in hexagonal close-packing with Cu flowing within interstitial channels is suggested. Investigation at room temp. shows that low-chalcocite (I) contains 96 Cu_2S , and has a_0 11.90, b_0 27.28, c_0 13.41 Å.; probable space-group $Ab2m$. The structure is based on hexagonal close-packed S atoms with Cu in fixed positions in the interstices. The multiplicity of the superstructure of (I) is 24. L. S. T.

Unit cell and space-group of kaliophilite. J. S. Lukesh and M. J. Buerger (*Amer. Min.*, 1942, 27, 226—227).—The hexagonal nature of the cell and the lattice const. as determined by Bannister are confirmed; a_0 is 26.94 Å. and c_0 8.55 Å.; space-group $C6_2(D_6^h)$. ρ 2.60 gives 54 $KAlSiO_4$ per unit cell. L. S. T.

Mafic and ultramafic rocks of the Baie Verte area, Newfoundland. K. de P. Watson (*J. Geol.*, 1943, 51, 116—130).—Field relationships, petrography, and chemical analyses of a group of igneous rocks characteristic of geosynclinal belts, viz., greenstone, ultramafics, and gabbro, that occurs in this area are discussed. L. S. T.

New Almaden [mercury] mine, the first chemical industry in California. H. M. Leicester (*J. Chem. Educ.*, 1943, 20, 235—238). L. S. T.

Structure and metamorphism of Early Precambrian rocks between Gordon and Great Slave lakes, North West Territories. J. F. Henderson (*Amer. J. Sci.*, 1943, 241, 430—446).—The Yellowknife group of Early Precambrian rocks, consisting of lavas overlain by graywackes and slates, has undergone at least two stages of metamorphism and deformation. The chloritic graywackes and slates were invaded by granite batholiths that thermally metamorphosed them over wide areas to knotted quartz-mica schist and hornfels. L. S. T.

Greenockite from Llallagua, Bolivia. S. G. Gordon (*Not. Naturæ*, 1939, No. 1, 6 pp.).—Greenockite from the Sn mines of this locality is described and illustrated; it is remarkable for its red colour and cyclic twinned crystals. L. S. T.

Thorium-free monazite from Llallagua, Bolivia. S. G. Gordon (*Not. Naturæ*, 1939, No. 2, 6 pp.).—The monazite, ρ 5.173, α 1.785, β 1.787, γ 1.840 (all ± 0.005), occurs in the Sn mine as flesh-pink, coarse granular aggregates of crystals intergrown with cassiterite. Spectrographic and radioactivity evidence shows that Th is absent. A chemical analysis is recorded. L. S. T.

Slavikite, butlerite, and parabutlerite from Argentina. S. G. Gordon (*Not. Naturæ*, 1941, No. 89, 8 pp.).—Occurrences, crystallography, and physical and optical properties are described. A chemical analysis of slavikite is recorded. L. S. T.

Magnetic properties of magnetites.—See A., 1943, I, 252.

X-Ray study of chrysotile asbestos. B. E. Warren (*Amer. Min.*, 1942, 27, 235).—A ribbon structure involving long but narrow Si_4O_{10} sheets is more probable than that of Si_2O_5 chains previously proposed. $Si_2O_5Mg_3(OH)_4$ has a Si:O ratio indicating a sheet structure, and it was only the fibrous nature of the material which suggested a chain structure. Chrysotile from Thetford Mines gives reflexions indicating a monoclinic cell with a_0 14.66, b_0 9.24, c_0 5.33 Å., and β $93^\circ 16'$, with c the fibre axis. The most obvious layer structure is one built up by the sequence $3O, 2Si, 2OOH, 3Mg, 3OH$. Diffuse reflexions are due to randomness in the stacking together of successive layers. L. S. T.

A., I.—General, Physical, and Inorganic Chemistry

NOVEMBER, 1943.

I.—SUB-ATOMICS.

Inverse Stark effect of sodium D line. H. Kopfermann and W. Paul (*Z. Physik*, 1943, 120, 545—552).—The inverse Stark effect produced by passage of Na D radiation through a beam of Na atoms has been investigated in fields up to 250 kv. per cm. The D_1 line consists of two π - and two σ -components, and the D_2 line of two π - and four σ -components. In the applied field, the D_1 line is displaced as a whole towards the red, whilst the σ -components of the D_2 line are each split into two. No additional π -components of the D_2 line are found. L. J. J.

Rôle of copper in the tungsten-copper-barium cathode. K. Brüning (*Physikal. Z.*, 1940, 41, 285—290).—The vaporisation of Cu alone and when covered with a layer of Ba has been investigated. Deactivation curves indicate that a Cu-Ba alloy, not containing W, is formed. The alloy attaches itself to the W wire better than Cu or Ba alone. The emission work for a W-Cu-Ba cathode is 1.05 v. It was determined at various temp. intervals, but no jump was observed in the val. at the m.p. of Cu, as might be expected. A. J. M.

Ionisation produced by single α -rays in different gases. G. Stetter [with W. Jentschke, E. Schachinger, and E. Maresch] (*Z. Physik*, 1943, 120, 639—651).—The authors' measurements of ionisation in air (A., 1935, 910) are extended to H_2 , N_2 , Ne, Ar, Kr, and Xe, giving vals. relative to air of 0.99, 0.96, 1.20, 1.26, 1.36, and 1.51, respectively. L. J. J.

Discharge-canal section and discharge produced by laterally-restricted irradiation. W. Fucks and H. Bongartz (*Z. Physik*, 1943, 120, 468—475).—Measurements of the lowering (δE) of the discharge potential across a spark-gap by irradiation of the cathode with ultra-violet light show that δE increases rapidly with the area irradiated up to an area corresponding with that operative in spark formation, and much more slowly at greater areas. The operative area increases slowly with length of spark-gap. The space based on this area is called the "electron-canal," in which electron-emission without ionisation occurs, and its area is $<$ that of the "canals" corresponding with later stages in the discharge by one or two orders of magnitude. L. J. J.

Classifications of the elements. I. Mainly stable. F. H. Loring (*Chem. Products*, 1943, 6, 51—58, 71).—Some numerical relationships existing between elements and isotopes are pointed out. A. J. M.

Has a caesium isotope of long half-life existed? Interpretation of unusual lines in mass-spectrography. J. Mattauich, H. Ewald, O. Hahn, and F. Strassmann (*Z. Physik*, 1943, 120, 598—617).—Mass-spectrographic examination of Ba from pollucite containing 30.77% of Cs_2O shows normal isotope distribution; hence Wahl's identification (*Soc. Sci. Fenn., Comm. Phys.-Math.*, 1940, 10, 18) of the 132 line with ^{132}Ba from β -active ^{132}Cs is incorrect. 80% of the Sr present is derived from β -active Rb (1.60% of Rb_2O present). The high-frequency spark method of ion-production employed gives rise to new lines ascribed to groups of atoms [e.g., C chains (C_{2-15}), Na_2Br , $BaOH$, etc.]. A no. of characteristic lines and isotope groups suitable for mass-assignment in mass-spectrography are given. L. J. J.

Existence of a group of elements in the space reserved for actinium in the periodic system. G. E. Villar (*Proc. 8th Amer. Sci. Congr.*, 1942, 7, 39—43).—On the basis of their electronic structure, Ac, Th, Pa, and U should occupy a single space in the periodic system. F. R. G.

Energy and range of slow α -rays. D. Hacman and O. Haxel (*Z. Physik*, 1943, 120, 486—492).—Energies of α -particles of range < 2 cm. have been determined by measurement of ionisation produced by the longest-range individual particles of a beam after interposition of varying thicknesses of air before the ionisation chamber. The method avoids errors due to scattering. The results agree with those of Holloway and Livingston (A., 1938, I, 426), and deviate somewhat from Livingston and Bethe's energy-range relation (*ibid.*, 7). L. J. J.

Normal radium standard. C. Weiss (*Z. Physik*, 1943, 120, 652—672).—A crit. discussion. L. J. J.

Energy expenditure in ionisation by radioactive recoil atoms. C. Gerthsen and E. Grimm (*Z. Physik*, 1943, 120, 476—485).—The equiv. range of Th- C' recoil atoms in air at atm. pressure is 0.228 mm.; 4700 ion pairs are formed per atom, with an expenditure of 36 e.v. per ion pair formed, in agreement with vals. for α - and H-rays. L. J. J.

Partition relations and energy of disintegration of uranium. A. Flammersfeld, P. Jensen, and W. Gentner (*Z. Physik*, 1943, 120, 450—467).—The energies of fragments produced simultaneously on both sides of a U film by slow-neutron bombardment give total energy of fragments 120—180 Me.v., and energy- or mass-ratio of simultaneously-formed fragments 0.4:1 to $\sim 1:1$. Equal fragments are not found. The most frequent disintegration process gives 151 Me.v. and mass-ratio 96:140. The results are in qual. agreement with Bohr and Wheeler's theory (A., 1939, I, 595). L. J. J.

Absorption of neutrons in aqueous solutions. Calculation of neutron absorption in the interior of a sphere. O. Haxel and H. Volz (*Z. Physik*, 1943, 120, 493—507, 507—512).—Scattering and capture of thermal neutrons by $AgNO_3$ solutions with addition of $Cd(NO_3)_2$ have been studied as a function of $[Ag]$ and $[Cd]$, giving comparative vals. for absorption cross-sections (σ) of Cd, H, and Ag. Assuming that $\sigma_{Cd} = 3.3 \times 10^{-21}$ sq. cm., σ_H is 0.24×10^{-24} sq. cm. and $\sigma_{Ag} = 5.5 \times 10^{-23}$ sq. cm. The capture-probability for neutrons in the Ag resonance range is $\propto [Ag]^{0.5}$, being 32% for 25 wt.-% $AgNO_3$. Several lines are involved in resonance-capture. L. J. J.

Capture of a slow-moving directed electron in a Coulomb field of force. W. R. Morgans (*Phil. Mag.*, 1943, [vii], 34, 537—549).—Mathematical. N. M. B.

Cosmic ray coincidences. W. Kolhörster (*Z. Physik*, 1943, 120, 539—544).—The accuracy of simplified methods of computing coincidence data is examined for a range of (mainly existing) data, with a variety of counter-pair arrangements. L. J. J.

Statistical analysis of the coincidences of cosmic rays. A. Baños, jun. (*Proc. 8th Amer. Sci. Congr.*, 1942, 7, 45—46).—Geiger-Müller counters have been installed at Mexico City for the investigation of cosmic rays. F. R. G.

Atmospheric absorption curves and their dependence on the nature of the primary cosmic rays. S. K. Chakrabarty (*Indian J. Physics*, 1943, 26, 121—129).—Atm. absorption curves for soft primaries have been calc. on the assumption that the no. of particles having energy E is $\propto E^{-(\gamma+1)}$, or that only discrete sets of isoenergetic particles are concerned. Comparison of observed and calc. curves proves the existence of protons in the primary cosmic rays. W. R. A.

Terrestrial magnetic field and its influence on cosmic radiation. M. S. Vallarta (*Proc. 8th Amer. Sci. Congr.*, 1942, 7, 29—38).—A survey. F. R. G.

Hard component of cosmic radiation. H. Kulenkampff (*Z. Physik*, 1943, 120, 561—577).—The mutual influence of disintegration and absorption must be taken into account in considering the intensity-variation of the mesotronic cosmic ray component. The intensity with varying absorption thickness (τ) is $\propto \tau^{-\gamma}$, where γ is const. at 2.1 with increasing inclination of the coincidence apparatus, increases from an initial val. 1.0 with increasing height above ground-level, and increases from 0 with increasing thickness of H_2O . A val. $(1.5 \pm 0.7) \times 10^{-6}$ sec. is found for the mean life. L. J. J.

Anomalous absorption in air and life of the meson. G. Bernardini (*Z. Physik*, 1943, 120, 413—436).—Measurements of three- and four-fold coincidences at Rome (50 m. altitude), Cervinia (2060 m.), and Pian Rosa (3480 m.) with compensation for atm. thickness above Rome by 35 cm. and 50 cm. of Pb, respectively, and comparison of the effects of interposing 20 cm. of Pb between the second and third counters at each station, gave disintegration-absorption data for air and the mean life-energy relation. The ionisation loss is 1.92 Me.v. per g. per sq. cm. The val. found for the life is $\sim 3 \times 10^{-8}$ sec. per Me.v., assuming a homogeneous hard component originating at < 4000 m. and formation of an electron and a neutrino on disintegration. L. J. J.

Direct mass determination of the mesotron by means of elastic collision. L. Leprince-Ringuet, E. Nageotte, S. Gorodetzky, and

R. Richard-Foy (*Z. Physik*, 1943, 120, 588—597).—Measurements on the trace in a cloud-chamber of a single elastic collision of a mesotron with a stationary electron in a magnetic field gave a val. for the mass of the mesotron of $240m$ ($\pm 10\%$). L. J. J.

"Observable magnitudes" in the theory of elementary particles. W. Heisenberg (*Z. Physik*, 1943, 120, 513—538).—Theoretical. Those concepts in existing quantum theory which are independent of later theoretical modifications to account for divergences are discussed. L. J. J.

Probable errors and limits of error in relation to the problem of atomic constants. U. Stille (*Z. Physik*, 1943, 120, 703—719).—The necessity of recording actual measurements rather than derived vals. is stressed, and the use of international electrical units is recommended. Limits of error are preferred to estimated probable errors in recording results. L. J. J.

II.—MOLECULAR STRUCTURE.

* Radiant properties and energy propagation in systems of densely packed similar atoms. F. Möglich and R. Rompe (*Z. Physik*, 1943, 120, 741—772).—Wave-functions for systems of densely-packed similar atoms are given. Broadening and displacement of absorption and emission frequencies and resonance fluorescence in such systems are calc. The theory explains Scheibe's observations on reversible polymerides of dye mols. L. J. J.

Spectrum of active nitrogen in the Schumann region. B. M. Anand, P. N. Kalia, and M. Ram (*Indian J. Physics*, 1943, 26, 69—78).—Emission and absorption spectra in the Schumann region of the active N afterglow have been investigated. Freezing-out of the active constituent, and the absence of 2D and 2P lines, render the at. hypothesis of Cario and Kaplan (cf. A., 1930, 124) unlikely, and support the mol. theories of Saha and Mathur (cf. A., 1936, 919) and Debeau (cf. A., 1942, I, 313). W. R. A.

Spectroscopic investigations of flames with atomic oxygen. K. H. Geib (*Z. Elektrochem.*, 1941, 47, 275—276).—At. O- C_2H_2 and at. O-MeOH flames are examined. In the O- C_2H_2 flames, attention is focussed on the weak bands at λ 3000—4000 Å., attributed by Vaidya (A., 1935, 279) to the CHO radical. O- C_2D_2 flames exhibit similar bands, showing that the radical responsible contains H. Experiments on O-MeOH and O-MeOD flames show that the OH in MeOH is not responsible for the OH emission observed. O atoms with H_2O_2 show no OH emission. J. F. H.

Metal carbonyls. XL. Absorption spectra of rhenium carbonyls. R. Schuh (*Z. anorg. Chem.*, 1941, 248, 276—282).—The absorption spectra of C_6H_{14} and dioxan solutions of $Re(CO)_5Hal$ and $[Re(CO)_5]_2$ (cf. A., 1943, I, 283) have been obtained. For the halogen compounds max. absorption occurs at ~ 3325 and ~ 2700 Å., the max. for $Re(CO)_5Cl$ and $Re(CO)_5Br$ being at slightly lower $\lambda\lambda$ in dioxan than in C_6H_{14} . For $Re(CO)_5I$ the difference between the two solvents is very small. $[Re(CO)_5]_2$ shows only one absorption max., at ~ 3100 Å.; here, also, the influence of solvent is negligible. C. R. H.

Absorption spectra of some *m*-substituted phenols, and the influence of nucleophilic substituents on electronic mobility. H. H. Hodgson (*J.C.S.*, 1943, 380—382).—The ultra-violet absorption spectra of *m*-substituted phenols, $R-C_6H_4-OH$ ($R = F, Cl, Br, I, OH, Me, OMe, OEt$) have been measured in neutral, acid, and alkaline solution, and compared with the absorption spectrum of PhOH. Between 2200 and 3200 Å. there is only one absorption band in each case. The band-envelope shifts are in the order $F < H < OH, Me, OMe, Cl < OEt < Br < I$, in neutral and acid solution, and $H < F < Me < OMe < OEt < OH < Cl < Br < I$, in alkaline solution. *The order of the shifts indicates the difference in *op*-directing power, and agrees with the effects on reactivity. A. J. M.

Ultra-violet absorption of dyes in solution, and influence of neutral salts on it. K. Chowdhury and C. Bose (*Indian J. Physics*, 1943, 17, 43—49).—The ultra-violet absorption of a no. of fluorescent dyes [succinylfluorescein (I) and pinakryptol-yellow (II) in glycerol; acriflavine (III), succinyleosin, pinaflavol, aniline-orange, rose-Bengal, and pinakryptol-green in EtOH] has been investigated. The effect of quenching by KI on (I), (II), and (III) has also been investigated, and it is shown that there is practically no change in the absorption curves on addition of KI. This indicates that quenching takes place by collisions of the second kind between mols. of dye and ions of added salt. A. J. M.

Fluorescence of silver halide-gelatin emulsions at low temperatures.—See B., 1943, II, 335.

Some problems of crystalline phosphors and insulators. K. Birus, F. Möglich, and R. Rompe (*Physikal. Z.*, 1943, 44, 122—129).—The quantum efficiency of phosphors is discussed. The fact that reflexion of light is very strong in the region of the fundamental lattice absorption is considered. The connexion between Dulong and Petit's law and the occurrence of multiple collisions, causing the disappearance of luminosity, is emphasised. A. J. M.

Experiments with electrets. I. B. Gross (*Anais Acad. Brasil. Cienc.*, 1943, 15, 63—83).—Application of an intense alternating field during the solidification of a condenser containing molten carnauba wax results in a dielectric hetero-charge and a dia-electric homo-charge. It is concluded that these are electrochemical in character. F. R. G.

Mathematics of turbid media. S. Q. Duntley (*J. Opt. Soc. Amer.*, 1943, 33, 252—257).—A review of existing analyses of the transmission of light through turbid media. L. J. J.

Transmission of light through a cloud of randomly distributed particles. G. N. Ramachandran (*Proc. Indian Acad. Sci.*, 1943, 17, A, 171—186).—The transmission of light through clouds of randomly distributed particles (transparent and opaque) is discussed theoretically. The intensity of transmission diminishes exponentially with the thickness of the medium; attenuation coeffs. have been calc. For transparent particles the transmitted intensity shows spectral variation. W. R. A.

Theory of coronæ and of iridescent clouds. G. N. Ramachandran (*Proc. Indian Acad. Sci.*, 1943, 17, A, 202—218).—A new theory is developed. The theory based on the idea that H_2O droplets act as opaque discs is theoretically unsound and conflicts with experimental facts; allowance must be made for transmission through the droplets. W. R. A.

Identification of interference phenomena by scattering particles in interference fields. E. Mollwo (*Z. Physik*, 1943, 120, 618—626).—Interferences produced by multiple reflexion at glancing incidence in a wedge-sectioned transparent LiF film condensed on a Ag mirror, and rendered visible by diffusion from local surface irregularities, are used for thickness determination by interference methods. L. J. J.

III.—CRYSTAL STRUCTURE.

Graphical interpretation of X-ray diffraction data using polar coordinates. W. C. White (*Amer. Min.*, 1943, 28, 99—102). L. S. T.

Rules for the conventional orientation of crystals. J. D. H. Donnay (*Amer. Min.*, 1943, 28, 313—328).—Rules intended to apply to all systematic descriptions, either morphological or structural, are detailed. L. S. T.

Symmetrically-excited electronic interferences. W. Kossel, I. Ackermann, and G. Möllenstedt (*Z. Physik*, 1943, 120, 553—560).—The fine structure and deviation from normal Bragg reflexion produced by simultaneous incidence of electrons from different directions on a lattice plane are discussed. L. J. J.

X-Ray analysis of thallium fluoantimonate, $TlSbF_6$, and some isomorphous alkali compounds. N. Schrewelius (*Arkiv Kemi, Min., Geol.*, 1943, 16, B, No. 7, 5 pp.).—Although $NaSbF_6$ crystallises in a cubic lattice, and the ions are arranged as in the NaCl crystal, compounds of the type $M^+SbF_6^-$ ($M^+ = Tl, NH_4, Rb, \text{ or } Cs$), in which the cation is larger, crystallise in the CsCl lattice. The structure is similar to that of compounds of the type $Zn(H_2O)_6SiF_6$. Lattice data are given. A. J. M.

Unit cell and space-group of claudetite.—See A., 1943, I, 288.

Positions of the carbon atoms in martensite. N. J. Petch (*Iron and Steel Inst.*, Feb., 1943, *Advance copy*, 7 pp.).—It is deduced from indirect evidence that the C atoms are situated at the mid-points of the long edges of the martensite tetragonal cell, and at the centres of the faces perpendicular to them (positions which are crystallographically equiv.). At most one twelfth of these positions are filled. S. J. K.

X-Ray studies of reactions of cellulose in non-aqueous systems. II. Interaction of cellulose and primary amines.—See A., 1943, II, 322.

Studies on the structure of thin metallic films by the electron microscope. R. G. Picard and O. S. Duffendack (*J. Appl. Physics*, 1943, 14, 291—305).—With an electron microscope of 30 Å. resolving power, a study was made of thin films, condensed on collodion in vac., of Al, Cd, Cu, Au, Mg, and Zn. An evaporating chamber allowing control of the temp. of the condensing surface was devised. Photographs of the surfaces show that all the films are made of agglomerates of the metals, separated by interstices of various widths. All evidence indicates an explanation of the surface structure by assuming migration of the atoms over the surface. The observed structure can be used to explain the electrical conductivity, optical reflectivity, and adsorptivity of thin films. Electron microscopical studies also allow a classification of surfaces according to the mobility of the atoms comprising them, and thus enable a rough estimate to be made of the potential distribution over the surface. N. M. B.

Crystal structure and electrical properties. J. Rottgardt and O. Stierstadt (*Metallwirts.*, 1941, 20, 765—771, 789—792, 903—910).—The mechanism of conduction of electricity by metals is considered in detail, with particular reference to the Bi crystal. From the

results obtained it is considered necessary to divide the metals into different "conductivity types," since the same conductivity mechanism does not seem to operate for all metals. The basis for such a classification is still not clear.
C. E. H.

Volume rectification of crystals. S. R. Khastgir (*Indian J. Physics*, 1943, 26, 111—113).—A review.
W. R. A.

Ultramicroscopic fine structure of fractured glass surfaces. E. Götz (*Z. Physik*, 1943, 120, 773—777).—Electron-microscopical examination of boundaries between "specular" and "furrowed" surfaces in glass fractures shows furrows extending into the specular portions.
L. J. J.

Structural homogeneity of glass. A. Winter (*J. Amer. Ceram. Soc.*, 1943, 26, 277—284; cf. B., 1943, I, 370).—The variation of n , dispersion, and thermal expansion of glasses is discussed with reference to the conditions existing above, below, and within the transformation range. It is shown that a glass which is initially free from mechanical strains (no birefringence) may not be in physico-chemical equilibrium at the temp. at which it is to be used, and may therefore develop strains, or its n may change, owing to its spontaneous transformation into the equilibrium state. Such spontaneous variation can be avoided only if the glass is annealed to max. n or ρ , as well as to freedom from birefringence.
J. A. S.

IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

Electron theory of superconductivity. H. Welker (*Physikal. Z.*, 1943, 44, 134—138).—The application of thermodynamics and electrodynamics to the problem of superconductivity is pointed out. It is shown how the phenomena of superconductivity can be explained on the assumption of an electron gas. The magnetic exchange interaction, with its dependence on the motion of the electrons, plays a special part in the explanation.
A. J. M.

Current distribution in superconductors. M. von Laue (*Z. Physik*, 1943, 120, 578—587).—Theoretical. Current distribution laws are generalised in the light of London's electrodynamics of superconductors.
L. J. J.

Grinding of macro-molecules. Explanation of the depolymerising effect of ultrasonic waves. G. Schmid (*Physikal. Z.*, 1940, 41, 326—337).—A theory of the depolymerisation produced by ultrasonic waves is suggested. The breakdown is due to frictional forces which come into play in the interior of the solution. In the concn. range found in a gel, the liquid, in consequence of the variation in elastic properties and ρ of the macro-mols., is not uniform, so that neighbouring particles in the solution do not execute equally strong vibrations. The free solvent vibrates through the meshes of a network of macro-mols., whilst the network itself cannot follow the ultrasonic vibrations on account of its inertia. This causes the development of frictional forces. It is shown that these forces would be sufficiently strong to break chemical linkings. It is also shown that in suitable solutions of high polymers, a dispersion of ultrasonic waves would be expected; such a phenomenon would provide a new method for investigation of the solutions.
A. J. M.

Application of photon statistics to the specific heat of a monatomic solid. B. N. Biswas (*Indian J. Physics*, 1943, 17, 1—5).—The expression for the sp. heat of a monat. solid with three degrees of freedom, obtained by applying the statistics of photons, is similar to that obtained by Debye. Expressions for entropy and free energy of the solid are also derived.
A. J. M.

Heats of vaporisation from reference substance plot. D. H. Gordon (*Ind. Eng. Chem.*, 1943, 35, 851—853).—Calculation of latent heats in the neighbourhood of crit. temp. is possible by an extension of Othmer's method (A., 1940, F, 314). A plot of the v.p. of a substance against that of a reference substance at the same reduced temp. vals. gives a straight line; the unknown latent heat can be calc. for the slope of this line, the latent heat of the reference substance, and the two crit. temp.
J. H. BA.

Phase transformations of normal paraffins. C. G. Gray (*J. Inst. Petroleum*, 1943, 29, 226—234).—The quantum theory of mol. heats leads to the equation $\theta = a - b/(n - 1)$, where θ is the m.p. of the normal paraffin C_nH_{2n+2} , and a and b are consts. Over the range $n = 20$ —36, in which the mols. are packed vertically on a regular hexagonal base, $a = 123.4$ and $b = 1659$. For $n \leq 36$, $\theta = 137.4 - 2266.7/n$, and this curve, depressed by 2.4° , continues along the transition points of the regular (α) and unsymmetrical (β) hexagonal packings down to $n = 26$, whence it is concluded that β is the form stable at the m.p. for $n \leq 36$. From $n = 6$ —20 the odd series is fitted by $\theta = 123.7 - 1908.86/(n + 1.779)$, and the even series (oblique packing, γ -form) by $\theta = 126.81 - 2143.41/(n + 3.7069)$. The latter curve is believed to continue as the $\alpha \leftrightarrow \gamma$ transition point for $n = 20$ —28.
A. R. PE.

Kinephotomic theory of atoms. A. do Prado (*Anais Acad. Brasil. Cienc.*, 1943, 15, 135—150).—It is deduced that the energy of

activation of a gas is equal to its energy of translation, and that the relation between pressure (p) and mol. velocity (u) is $p = 2\rho u^{2/3}$.
F. R. G.

Nomograph for P - V - T relations of gases below the critical point. G. W. Thomson (*Ind. Eng. Chem.*, 1943, 35, 895).—Equations and a nomograph are given, from which the compressibility and activity (fugacity/pressure) of hydrocarbons may be obtained at pressures and temp. below the crit. point.
J. H. BA.

Phase equilibria in hydrocarbon systems. Volumetric behaviour of methane. R. H. Olds, H. H. Reamer, B. H. Sage, and W. N. Lacey (*Ind. Eng. Chem.*, 1943, 35, 922—924).—The compressibility factor for CH_4 has been obtained for pressures up to 10,000 lb. per sq. in., at 100—460° F. A comparison is made with previous data.
J. H. BA.

Three types of energy of viscosity. A. E. Dunstan and A. H. Nissan (*Phil. Mag.*, 1943, [vii], 34, 479—486).—The val. of η for simple liquids is dependent on three factors; one is invariant and almost independent of temp., but the other two depend on temp. to different extents, equating at the crit. temp. and cancelling each other owing to their opposite signs. There appears to be an inherent increase in η with temp. which is masked by the larger decrease. In gases the opposite appears to be true. Probably the mechanism of viscosity in gases and liquids is essentially the same.
W. R. A.

Relationship between viscosity and temperature. H. G. de Carvalho (*An. Assoc. Quim. Brasil*, 1943, 2, 21—28).—The relationship $\log \eta = -A + B/T + C \log T$ is in agreement with the experimental vals. for C_6H_6 , $CHCl_3$, and $EtOH$.
F. R. G.

V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

Elementary theory of thermal diffusion. R. N. Rai and D. S. Kothari (*Indian J. Physics*, 1943, 26, 103—106).—Mathematical. Derivation of the coeff. of thermal diffusion and its variation with concn. are discussed and compared with the experimental results of Grew (cf. A., 1942, I, 15) for $Ne-NH_3$, which are in fair agreement with theory.
W. R. A.

Viscosity function. IV. Non-ideal systems. E. P. Irany (*J. Amer. Chem. Soc.*, 1943, 65, 1392—1398).—Graphical analysis of η -concn. data for non-ideal binary systems is discussed, and the functional scales previously described (cf. A., 1942, I, 51) are applied to existing and measured data for $Et_2O-H_2SO_4$, and for mixtures of H_2O with dioxan, and with mono- and poly-hydric alcohols, and of $HCO-NH_2$ with H_2O , dioxan, alcohols, and aliphatic acids.
W. R. A.

Dependence of velocity of sound on concentration in a dipolar-non-polar liquid mixture. K. Sacher (*Physikal. Z.*, 1940, 41, 360—362).—The variation of the velocity of sound with concn. in $EtOH-CCl_4$ mixtures was investigated. There is a min. for a mol. fraction of $EtOH$ of 0.05. The adiabatic compressibility also shows a definite change at this concn.
A. J. M.

Apparent ionic volume in infinitely dilute solutions. F. H. Lee and C. S. Sie (*J. Chinese Chem. Soc.*, 1942, 9, 134—140).—An equation similar in form to van der Waals' equation is found to represent the apparent ionic vol. of alkali halides at temp. 0—50°. At infinite dilution a linear relation between apparent ionic vol. and spherical vol. of ions in the cryst. salts is found.
L. J. J.

Propagation of elastic waves through electrolytic solutions. A. K. Dutta and B. B. Ghosh (*Indian J. Physics*, 1943, 17, 19—25).—The velocity of supersonic waves shows first a decrease and then an increase with concn. in the case of the heavy alkali halides (KBr and KI), the effect being greater at higher temp. This is contrary to results obtained with other electrolytes, which normally show an increase of velocity with concn. The connexion of the phenomenon with viscosity is discussed.
A. J. M.

Complex ions. V. Magnetic moments of complex ions of nickel and copper. C. D. Russell, G. R. Cooper, and W. C. Vosburgh (*J. Amer. Chem. Soc.*, 1943, 65, 1301—1306).—Magnetic moments of complex ions of Ni and Cu with C_6H_5N , NH_3 , glycine, $(CH_3NH_2)_2$, and o -phenanthroline have been determined, and their relative stabilities measured spectrophotometrically. For each the orbital magnetic moment is $<$ that of the parent ion, the decreases being \propto stability. Magnetic moment is \propto max. absorption.
W. R. A.

Electrochemical investigation of the system gold-antimony. F. Weibke and G. Schrag (*Z. Elektrochem.*, 1940, 46, 658—661).—E.m.f. measurements were made between Sb and Au-Sb alloys containing 25.1 (eutectic), 40.0, 50.3, and 75.1% Sb, in an electrolyte consisting of $SbCl_3$ dissolved in fused $LiCl-RbCl$ eutectic, over the temp. range 312—353°. At $\sim 318^\circ$ the e.m.f. were 19.4, 18.6, 15.7, and 0.6 mv. respectively. All the e.m.f. decreased with increasing temp. The measurements give: $\frac{1}{2}Au + Sb = \frac{1}{2}AuSb_2 + 2.4 \text{ kg.-cal.}$
R. K.

Solubility of tin in magnesium. H. Vosskühler (*Metallwirts.*, 1941, 20, 805—808; cf. A., 1934, 1065).—The solidus and solid solubility line at the Mg end of the Mg-Sn system have been deter-

mined by an electrical resistivity method. The eutectic temp. is 562° and the solid solubility at this temp. is 15.2 wt.-% of Sn. The solubility decreases to 0.45% at 200° . The solidus line remains practically the same as in previous work. C. E. H.

Solubility of hydrogen in iron and iron alloys.—See B., 1943, I, 411.

Empirical relation between solubility of slightly soluble electrolytes and dielectric constant of the solvent. J. E. Ricci and T. W. Davis (*Kolloid-Z.*, 1940, 91, 196—198).—See A., 1940, I, 207. C. R. H.

Elevation of the solubility of alumina in kaolin by preheating in gases. G. F. Hüttig and E. Herrmann (*Z. Elektrochem.*, 1941, 47, 282—285).—Various samples of kaolin are heated in air, N_2 , O_2 , HCl, H_2O vapour, SO_2 , NH_3 , $NO_2 + O_2$, and moist NO_2 at temp. from 20° to 800° . The gases affect to different extents (i) the amount of H_2O evolved during heating, (ii) the temp. at which meta-kaolin is formed, (iii) the HCl-solubility of the Al_2O_3 and SiO_2 in the product (the increase in solubility of Al_2O_3 being $>$ that of SiO_2), (iv) the adsorptive properties of the kaolin. The dehydration process is divided into three parts. The solubility of the Al_2O_3 is affected also by the period of heating and by the acid used as solvent. J. F. H.

Low-temperature adsorption of nitrogen, oxygen, argon, hydrogen, *n*-butane, and carbon dioxide on porous glass and partly dehydrated chabasite. P. H. Emmett and T. W. DeWitt (*J. Amer. Chem. Soc.*, 1943, 65, 1253—1262).—The adsorption near their b.p. of N_2 , O_2 , A, H_2 , $n-C_4H_{10}$, and CO_2 on porous glass and partly dehydrated chabasite has been determined. The reproducible hysteresis encountered in adsorption on porous glass is discussed. The average pore size of the porous glass has been calc. by various methods, and the upper limit of pore radius, calc. by Kelvin's equation, is ~ 60 Å. W. R. A.

Adsorption and desorption processes during the streaming [of gas] through layers of granular adsorbent. Concluding experiments and theoretical. E. Wicke (*Kolloid-Z.*, 1940, 93, 129—157).—Experiments on the adsorption of CO_2 by active C have been carried out in order to complete earlier work. A mathematical treatment of adsorption and desorption is presented, the rate of gas diffusion into the interior of the granules, the slow mixing of gases in the pores of the adsorbent, and the curvature of the adsorption isotherm being among the subjects considered. Errors in earlier papers are corr. (cf. A., 1939, I, 254; 1940, I, 207). C. R. H.

Heat of adsorption of ethyl chloride and of sulphur dioxide on sugar charcoal.—See A., 1943, I, 279.

Multiplication process for the separation of racemates. H. Martin and W. Kuhn (*Z. Elektrochem.*, 1941, 47, 216—220).—The principle involved is the preferential adsorption of either the *d*- or *l*-component by optically active adsorption media, a fall in temp. displacing the relative concn. in the adsorbate in favour of the component with the higher heat of adsorption. The equilibrium conditions obtaining for this component in an enclosed space interspersed throughout with adsorbent, when the upper part is kept hot and the lower cold, are considered. If N_h and N_c are the respective mol. fractions of the component in the adsorbate in the hot and cold parts of the system, $N_c = N_h(1 + \delta)$, where δ is small and positive. This individual effect, by employing a long, narrow, horizontal enclosure and making the liquid circulate along the entire length of the heated upper surface and back along the cooled lower surface, can be multiplied by L/a for the concns. resulting at the extreme ends of the enclosure, L and a being the length and width respectively, provided the circulation velocity u has the optimum val. $u_0 = 2D/a$, where D is the diffusion coeff. If $u = su_0$, the separation will be decreased by the multiplying factor $2s/(1 + s^2)$. The time factor which would be involved in the attainment of equilibrium is discussed from a practical viewpoint. For the case when the liquid is stationary and the adsorbent circulated, experimental evidence for separation was obtained by measuring the sp. rotation of the resulting liquid portions at each end of the system. *dl*-Mandelic acid was employed as the racemate and wool, which is known to be built up of optically active NH_2 -acids, as the adsorbent. The upper surface was kept near 100° and the lower at room temp. In the resulting fractions, vals. for $[a]_D > 1.0^{\circ}$ were observed. L. H. L.

Cation and anion interchange with zinc montmorillonite clays. M. M. Elgabaly and H. Jenny (*J. Physical Chem.*, 1943, 47, 399—408).—The mechanism of Zn fixation on Na-, Ca-, and H-bentonites and the release of adsorbed Zn from Zn-bentonite (I) has been investigated. The uptake of Zn from solutions of $ZnCl_2$ involves Zn^{++} , $ZnCl^+$, and $ZnOH^+$, and the release of Zn from (I) by NaCl and $CaCl_2$ is restricted mainly to bivalent Zn. (I) possesses strong anion-changing properties, Cl^- , OH^- , and NO_3^- being mutually replaceable. (I) is regarded as possessing a mosaic surface capable of independent cation and anion exchange. C. R. H.

Equilibria in carbonaceous cation exchanger. H. F. Walton (*J. Physical Chem.*, 1943, 47, 371—382).—Zeo-Karb, a so-called sulphonated coal, was the exchanger used in a series of experiments

on Na^+-K^+ , Na^+-Ca^{++} , $Ca^{++}-Ba^{++}$, Na^+-H^+ , and $Ca^{++}-H^+$ exchange. Except for Na^+-Ca^{++} , where there was hysteresis, the exchanges were reversible. Exchanges involving H^+ showed deviation from the law of mass action indicating that Zeo-Karb is non-homogeneous, having a no. of acidic groups of diverse character, although it behaves as a nearly uniform gel towards other cations. In $Ca^{++}-H^+$ exchange at low $[H^+]$ the intake of Ca^{++} increased with decrease in $[H^+]$ without showing signs of reaching saturation. C. R. H.

Antonoff's rule. A. Yoffe and E. Heymann (*J. Physical Chem.*, 1943, 47, 409—410).—The non-validity of Antonoff's rule is discussed. The rule is shown to be approx. valid for org. liquid- H_2O systems if the org. phase consists of weakly hydrophilic substances. C. R. H.

Capillary systems. XIX/11. Canal number distribution curve for polycapillary canal systems. Theoretical. E. Manegold, S. Komagata, and E. Albrecht (*Kolloid-Z.*, 1940, 93, 166—199).—The mathematical treatments by Erbe (cf. A., 1933, 672) and by Grabar and Nikitine (cf. A., 1937, I, 77) of canal no. distribution curves have been extended and applied to existing data. C. R. H.

Kinetics of order-disorder transformations in metal films. R. Suhrmann and H. Schnackenberg (*Z. Elektrochem.*, 1941, 47, 277—281).—Amorphous layers of Ni, Fe, Cu, Ag, Au, Pb, and Bi are formed by vaporisation in a high vac. followed by condensation at very low temp. The layers have high electrical resistance (R) which is decreased on prolonged heating owing to the formation of cryst. material. The order-disorder reaction is studied by rapid heating to a higher temp., and maintaining this temp. during measurements of the decrease of R with time (t). Empirical relationships between R and t are derived and kinetic considerations provide equations of the same form. The energy of activation of the process is > 1000 g.-cal. per g.-atom and approx. equals energy of vibration of the lattice. J. F. H.

Donnan membrane equilibrium. S. G. Chaudhury (*J. Proc. Inst. Chem. India*, 1942, 14, 220—225).—Mathematical. The dependence on the val. of the membrane potential (E_m) of the accuracy of equations connecting E_m with osmotic pressure differences is discussed. C. R. H.

Filterability and liquid absorption of sediments. A. von Buzágh and E. Erényi (*Kolloid-Z.*, 1940, 91, 191—196).—A series of experiments on the filtration of powdered SiO_2 from aq. solutions of inorg. salts has shown that there is a close relation between filterability (F), liquid absorption (w), sediment vol. (v), and particle size. With increasing concn. of salt, F , w , and v increase, fairly regularly in the case of NaCl, K_2SO_4 , and K_3PO_4 , and rapidly to a const. val. in the case of $BaCl_2$ and $MgSO_4$. In the case of $AlCl_3$ F , w , and v increase rapidly with concn. to a max. val. and then fall to a const. val. C. R. H.

Mechanism of the formation of Kohlschütter's silver sol. II. H. B. Weiser and M. F. Roy (*J. Physical Chem.*, 1943, 47, 325—329).—When CO is passed through Ag_2O solutions Ag hydrosol is formed. With unfiltered saturated solutions the hydrosol is very stable, but in presence of excess of Ag_2O the solution deposits within a few weeks a reddish-brown layer, leaving a clear yellow sol which is green by reflected light. The hydrosols are purer and more uniform than those obtained with H_2 as reducing agent, mainly because in the latter case excess of Ag_2O must be present and, furthermore, reduction is incomplete. (Cf. A., 1934, 25.) C. R. H.

New effects due to anisotropy of colloidal particles. R. E. D. Clark (*Chem. and Ind.*, 1943, 348—350).—Application of a high potential gradient to bentonite (I) suspensions causes orientation of particles at electrodes. At the anode they form closely packed layers causing almost immediate polarisation. This momentarily disappears on reversal of current or when another anode is substituted, but not when the cathode is replaced by another. Keeping the anode in motion breaks up the orientation and gives increased current. Such a system acts as a rectifier. NH_4 oleate and egg-albumin (at pH 8, not at pH 5.5) show similar effects, but not starch. At the cathode, (I) suspension (particles probably perpendicular to plane) has greater conductivity than in bulk since movement of the cathode decreases the current. Orientation also accounts for changes in the coeff. of friction (μ) between surfaces lubricated by (I) when a p.d. is established between them. Anomalous conductivity of (I) suspensions is also explained. J. H. BA.

Properties of dialysed hydrous alumina hydrosols. I. pH changes due to ageing, and titration with neutral salts. N. P. Datta (*J. Indian Chem. Soc.*, 1942, 19, 159—174).—Various sols, dialysed to different extents, all show a decrease in pH on ageing. Conductometric titres of Cl content with Ag salts differ with the Ag salt used, but are $<$ the total Cl content. This indicates that Cl is present both bound and free. The fraction of bound Cl increases with extent of dialysis. Neutral salts increase pH and Cl^- activity. A constitution for the sols is suggested and discussed. J. H. BA.

Variation in electrochemical properties of hydrogen-clay sols with temperature. B. Chatterjee and A. Sen (*J. Indian Chem. Soc.*, 1942,

19, 189).—The H-clay sol Padegaon-B shows an increase in free acidity, total acidity, and degree of dissociation, with rise in temp.

J. H. BA.

Determination of electrolyte content in the intermicellar portion of colloidal solutions. R. Wintgen (*Kolloid-Z.*, 1940, 93, 257—280).—The course of ultrafiltration with collodion membranes and with porcelain filter plates by Zsigmondy's method has been investigated for a no. of sols of various types. The process is sometimes normal, but frequently abnormal. Even when it takes the normal course, it is not always possible to draw conclusions about the composition of the intermicellar liquid from that of the ultrafiltrate. This uncertainty is due to the fact that ordinary electrolytes may suffer a change in composition during ultrafiltration. Thus, in the ultrafiltration of dil. HCl with Zsigmondy's apparatus, the filtrate is less conc. than the original, and part of the H^+ of a sol can be replaced by Ca^{++} from the filter plate. This can be avoided by using collodion sacks, as in Wintgen and Hacker's process (A., 1933, 124). With a Fe_2O_3 sol, the conductivity of the ultrafiltrate using the collodion sack method, can be calc. on the basis of the Donnan equilibrium from the potentiometrically determined activities of H^+ and Cl^- in the sol, and the velocity of transport of the ions. In equalised ultrafiltration, where the ultrafiltrate remains in contact with the sol residue across the membrane for several days, so that equilibrium may be reached, the sol behaves differently. Thus, in the equalised ultrafiltration of a Cr_2O_3 sol, the conductivity of the sol can be calc. by the method of mixtures from the vol. and conductivity of the ultrafiltrate and those of the sol residue, and when these two are remixed the sol has the original conductivity. With a Fe_2O_3 sol, small but definite departures from additivity occur, possibly due to a loss of HCl from the Fe_2O_3 micellar ions.

A. J. M.

Relations between electrical conductivity and degree of dispersion of lyophilic colloids. IV. Electrical conductivity of solutions of sodium oleate in presence of the isomeric cresols. E. Angelescu and A. Woinarosky (*Kolloid-Z.*, 1940, 93, 199—207).—The electrical conductivity of solutions (0.1—0.4N.) of Na oleate (I) in presence of 0—10% of cresol has been measured over the range 20—60°. In absence of cresol the mol. conductivity (λ) is const. for solutions 0.1—0.3N., but λ decreases at higher concns. The val. of λ is 5—10 times the corresponding val. for equimol. solutions of Na stearate. This is due to differences in the degree of dispersion. With increasing addition of cresol λ rises to a max. and falls, a preliminary fall to a min. val. also occurring at low temp. and for high concns. of (I). This min. is most pronounced with *p*-cresol. As temp. rises and concn. of (I) diminishes the differences between the effects of *o*-, *m*-, and *p*-cresol disappear. The free affinity forces of the double bond and the electrical forces due to dissociated groups are the forces mainly responsible for the phenomena.

C. R. H.

Transformation of cellulose hydrate into natural cellulose. V. Mechanism of the transformation and stability of natural cellulose and of cellulose hydrate. T. Kubo (*Kolloid-Z.*, 1940, 93, 338—345).—X-Ray diagrams indicate that cellulose hydrate and its derivatives are converted into natural cellulose on heating in polar liquids, such as glycol and glycerol. The effect of cooling at various rates on the transformation has been investigated. The hydrate was heated to 250° with glycerol, and then cooled by water at 0°, solid CO_2 , liquid air, or slowly (8 hr.) to room temp. or at the normal speed to room temp. These different treatments did not greatly affect the degree of transformation of the hydrate, as indicated by X-ray diagrams. The mechanism of the transformation and the stability of natural and hydrate cellulose are discussed on the basis of the thermochemical and electrokinetic behaviour of these compounds.

A. J. M.

Starch gels. W. Seck and G. Fischer (*Kolloid-Z.*, 1940, 93, 207—224).—The relation between the gel-forming properties of starches and their behaviour on swelling is discussed. η and elasticity measurements on starches which have been swollen by different methods have been made, and the effects of acid hydrolysis and oxidation have been studied. Gel-forming starches have a lower η than non-gel-forming starches but there is no general relation between η and degree of gel-formation. Seed starches are gel-forming but stem and root starches are non-gel-forming. Gel-forming tendencies are increased by oxidation and hydrolysis.

C. R. H.

Mechanical and material properties of fibrin. U. Ebbecke (*Kolloid-Z.*, 1940, 91, 134—152).—Fibres and films of fibrin were prepared and examined as to their physical and mechanical properties. Comparison was made with collagen, gelatin, elastoidin, myosin, casein, polyamides, keratin, and rubber. The property changes which take place during stretching and as a result of adsorption and removal of liquid are illustrated with the aid of the mesh structure conception.

C. R. H.

Influence of heat-treatment on solutions of crystalline horse serum-albumin. G. R. Cooper and H. Neurath (*J. Physical Chem.*, 1943, 47, 383—398).—The effects of heat-treatment on solutions of cryst. horse serum-albumin depend on pH and ionic strength of the solutions. At pH 7.6 the degree of aggregation increases with increasing

ionic strength and the heated protein differs from the unheated protein in average particle size, electrophoretic pattern and mobility, and in susceptibility to tryptic digestion. At pH 3.6 heat-treatment produces slight changes in particle size and heated and unheated proteins show the same electrophoretic pattern, although the electrophoretic mobility of the heated protein is $\sim 20\%$ > that of the unheated protein. Readjustment of pH to near the isoelectric point does not reverse these changes. Heating at pH 4.2 results in polymerisation with an 8-fold increase in mol. wt.

C. R. H.

VI.—KINETIC THEORY. THERMODYNAMICS.

Equilibrium of gaseous dibromoethylenes.—See A., 1943, I, 280.

Complex boric acid-polyhydroxyl compounds. J. Y. Tung and H. L. Chang (*J. Chinese Chem. Soc.*, 1942, 9, 125—133).—The effect of arabinose, pyrocatechol, fructose, galactose, mannitol, and xylose on the pH of H_3BO_3 solutions has been examined. The effects found agree with the expression $pH = -\frac{1}{2} \log \{6.5 \times 10^{-10} [H_3BO_3] (1 + K[X]^2)\}$ at 25°, where K is 1.45×10^4 , 3.63×10^5 , 2.75×10^6 , 1.41×10^3 , 2.75×10^6 , 1.58×10^4 for the above polyhydroxy-compounds (X) respectively. The complexes formed are $H_3BO_3 \cdot X_2$, with m.p. 146—148°, 132°, and 172—173° for the mannitol, xylose, and fructose complexes, respectively.

L. J. J.

Inadequacy of pH and pR to express acidity. rA. R. A. Catani (*Rev. Brasil. Quím.*, 1943, 15, 264—269).—Acidity may with advantage be defined as the no. of mg.-equiv. of H^+ per c.c. which is, unlike pH, independent of temp.

F. R. G.

Apparent dissociation constants of galactose-1-phosphoric acid. H. W. Kosterlitz (*Biochem. J.*, 1943, 37, 321—322).—The acid has $pK_1' 1.0$ and $pK_2' 6.17$.

W. McC.

Acid strengths of aliphatic nitro-compounds. G. W. Wheland and J. Farr (*J. Amer. Chem. Soc.*, 1943, 65, 1433).— pK at 25° of the nitro-forms are $MeNO_2 10.24$, $EtNO_2 8.60$, $Pr^iNO_2 8.98$, and $Pr^tNO_2 7.7—7.8 \pm 0.04$. The low val. for Pr^tNO_2 is due to the lines of force between the NO_2 and H^+ passing through the Me (cf. Turnbull *et al.*, A., 1943, I, 153; Westheimer *et al.*, A., 1939, I, 263).

R. S. C.

Dissociation of certain amino-acids in dioxan-water mixtures. E. L. Duggan and C. L. A. Schmidt (*Arch. Biochem.*, 1943, 1, 453—471).—Potentiometric titration curves are given for α - and β -alanine, γ - and δ -aminovaleric acid, glutamic acid, lysine, arginine, and histidine in H_2O and 20 wt.-% aq. dioxan. The apparent dissociation consts. in H_2O , 20% dioxan, and 65% and 86% aq. EtOH are compared; these depend on the activity and the ionisation const. of H_2O in the solvent, the dielectric const. of the solvent, and variations in the inductive effect of polar groups on the proton of the dissociating group of the mol. with change in H_2O content of the solvent.

E. R. S.

Effect of neutral salts on dissociation of certain amino-acids in dioxan-water mixtures. E. L. Duggan and C. L. A. Schmidt (*Arch. Biochem.*, 1943, 1, 473—486; cf. A., 1940, I, 116; 1941, I, 47).—Curves are given showing the effect of NaCl, KCl, LiCl, $MgCl_2$, and $CaCl_2$ on the apparent dissociation consts. of α - and β -alanine, γ - and δ -aminovaleric acid, lysine, histidine, arginine, and glutamic acid in 20 wt.-% aq. dioxan. There is no material difference between the effects of salts in H_2O and 20% dioxan.

E. R. S.

Activity of osmotic coefficients of sodium chlorate by an isopiestic method. J. H. Jones (*J. Amer. Chem. Soc.*, 1943, 65, 1353—1354).—Isopiestic ratios of aq. NaCl and $NaClO_3$ (0.2—3.0M.) have been determined, and used to calculate the activity and osmotic coeffs. of $NaClO_3$ by comparison with existing data for NaCl.

W. R. A.

Ternary system $MgO-Al_2O_3-Cr_2O_3$. W. T. Wilde and W. J. Rees (*Trans. Ceram. Soc.*, 1943, 42, 123—155).—The abnormally high m.p. of 2135° for Cr_2O_3 given by Bunting (A., 1931, 41) has not been confirmed. The suggestion that the more usually observed m.p. (2060—2080°) is due to the formation of a lower oxide has been disproved by the demonstration that reduction establishes an equilibrium of metallic Cr and Cr_2O_3 . The system $Al_2O_3-Cr_2O_3$ shows complete solid solution. The system $MgO-Al_2O_3$ has only one compound, $MgO \cdot Al_2O_3$, which can take a large amount of Al_2O_3 (but no MgO) into solid solution at high temp., from which Al_2O_3 is pptd. on slow cooling. The system $MgO-Cr_2O_3$ has only one compound, $MgO \cdot Cr_2O_3$, which does not dissolve either MgO or Cr_2O_3 . The system $MgO-Al_2O_3-Cr_2O_3$ forms a complete series of solid solutions and no ternary compound. The lattice dimensions of the spinel compounds depend solely on the relative proportion of Al_2O_3 and Cr_2O_3 present in the high-MgO part of the field, and MgO also has an effect in the low-MgO region. The variation of lattice dimension with composition is not completely regular and an explanation is suggested.

J. A. S.

Mutual melting relations of pyroxenoids, melilites, and olivines in the quaternary system $CaO-FeO-Al_2O_3-SiO_2$.—See A., 1943, I, 268.

Heats of formation of the lower phosphides of several heavy metals. F. Weibke and G. Schrag (*Z. Elektrochem.*, 1941, **47**, 222—238).—The heats of formation of Fe_2P ($34.5 \pm 2\%$), Fe_3P ($35.2 \pm 2\%$), Co_2P ($42.9 \pm 2\%$), Ni_3P_2 ($95.9 \pm 2\%$), Ni_3P ($48.4 \pm 2\%$), and Cu_3P ($32.0 \pm 4\%$ kg.-cal. per g. mol.), from the metal and red P, are determined at 630° . Known mixtures of the finely-divided, freshly reduced metal and P are formed into pastilles, preheated, and used in an improved version of the adiabatic high-temp. calorimeter of Kubaschewski and Walter (A., 1939, I, 579). Graphs of at.-% P-heat of formation per g.-atom of alloy are nearly linear within the range 5—30 at.-% P. The results are combined with those of Biltz *et al.* for the higher phosphides of the metals studied and the heats of formation of the complete metal-P systems are derived. These are compared with the vals. for the corresponding aluminides and silicides. J. F. H.

Heats of polymerisation of vinyl compounds. G. Goldfinger, D. Josefowitz, and H. Mark (*J. Amer. Chem. Soc.*, 1943, **65**, 1432—1433).— ΔH of polymerisation of styrene, $\text{CH}_2\text{:CMe}\cdot\text{CO}_2\text{Me}$, and $\text{CH}_2\text{:CH}\cdot\text{OAc}$, determined calorimetrically, are 15.0, 7.9, and 8.0 kg.-cal. per mol. W. R. A.

Heat of adsorption of ethyl chloride and of sulphur dioxide on sugar charcoal. S. J. Gregg (*J.C.S.*, 1943, 351—355).—The heats of adsorption have been measured and the adsorption isotherms determined from very low pressures up to atm. for SO_2 and up to 469 mm. for EtCl . The differential heat of adsorption of EtCl falls rapidly from 11,500 to 6000 g.-cal. per mol. within a narrow adsorption range and at ~ 100 mm. This fall is ascribed to the completion of a unimol. layer of EtCl and the inception of a thicker layer. Although the data do not conform to Henry's law, they are not considered as disproving that law since the adsorbed layer may not have been sufficiently dil. to behave as a perfect two-dimensional gas. C. R. H.

VII.—ELECTROCHEMISTRY.

Redox theory of electric cells. D. Giribaldo (*Proc. 8th Amer. Sci. Congr.*, 1942, **7**, 145—167).—A general equation of electrolytes is proposed, on the basis of the different degrees of oxidation of the ions present. F. R. G.

Pulsations on mercury surface caused by polarisation. K. S. G. Doss and B. S. Rao (*Proc. Indian Acad. Sci.*, 1943, **A**, **17**, 158—160).—Hg in contact with a solution containing acid and an oxidising agent (e.g., $\text{H}_2\text{SO}_4 + \text{K}_2\text{Cr}_2\text{O}_7$) becomes anodically polarised. If the Hg surface is now touched by Fe wire a voltaic cell is formed with Fe as anode and Hg as cathode. The Hg becomes cathodically polarised, interfacial tension increases, and the Hg contracts laterally and recedes from the Fe. Out of contact with Fe, Hg becomes anodically polarised and the process repeats itself, giving rise to pulsations ("the Hg heart"). Various conditions under which the effect is displayed have been investigated. W. R. A.

Overvoltage. XV. Decomposition potentials. Cathodic and anodic polarisation of a platinised platinum cathode near the reversible value in hydrogen-saturated acid solutions. XVI. Cathodic and anodic polarisation of a platinised platinum cathode near the reversible value in nitrogen-saturated acid solutions. A. L. Ferguson and M. B. Towns (*Trans. Electrochem. Soc.*, 1943, **83**, *Preprints* 8 and 9, 105—117, 119—128; cf. A., 1943, I, 18, 63).—XV. The potential (V) of a platinised Pt electrode has been studied as it is subjected to cathodic and anodic currents in still and stirred $2\text{N}\cdot\text{H}_2\text{SO}_4$ saturated with H_2 . During cathodic charge V changes in a non-linear manner from zero to a stable negative val. which is higher for still than for stirred solution. It is suggested that V is determined by the concn. of at. H at the interface and that stirring hastens the diffusion of H atoms into the solution. Low anodic polarising currents cause V to rise in still solutions to a stable positive val. \ll the potential at which O_2 is normally evolved and this V is considered to represent the state at which the consumption of H_2 equals the rate of supply of H_2 to the surface by diffusion. Higher c.d. causes V to rise to the potential of O_2 evolution. On anodically polarising an electrode which has previously been a cathode the V -time curve shows an inflexion with more rapid rise of V between $+0.30$ and $+0.87$ v. A similar break in the curve is observed on reversing the current. In stirred solution stable vals. of V very little above the reversible val. are established with low currents and only with relatively high c.d. does V reach the val. for O_2 evolution. The inflexion in the V -time curve is similar to that for still solutions. It is suggested that at $< +0.30$ v. the current is used in producing H^+ ions from H atoms, some of which are supplied to the surface from mols. in the solution, whereas at $+0.30$ to $+0.87$ v. the process does not directly involve H_2 mols. from the solution.

XVI. When a platinised Pt electrode in $2\text{N}\cdot\text{H}_2\text{SO}_4$ saturated with N_2 is made to assume a positive potential and then made a cathode at low c.d. V falls gradually to a stable val. more positive than the reversible potential and higher for stirred than for still solution. It is suggested that H^+ ions are discharged throughout this process and the $[\text{H}^+]$ at the interface increases until a back potential approx.

equal to the applied potential is built up, after which the current passed is required to maintain the $[\text{H}^+]$. With higher c.d. the stable potential is negative and is lower for the stirred solution. All the V -time curves have a linear section from $\sim +0.30$ v. to the final stable val. During anodic polarisation from a stable cathodic val. the V -time curves have two linear portions, a slow change extending to $+0.30$ v. and a more rapid change between $+0.30$ and $+0.87$ v., followed by a slower increase in V to the potential of O_2 evolution. A rapid change from $+0.87$ to $+0.30$ v. is also observed when the potential is reversed. The results support the view that the potential depends on the activity of H atoms and H^+ ions at the electrode-solution interface. J. W. S.

VIII.—REACTIONS.

Kinetics of chemical reactions. F. Olmer (*J. Physical Chem.*, 1943, **47**, 313—317).—A new method of studying reactions, in which variations in a physical property are measured during the linear raising (*i.e.*, with time) of the temp. of the system, has been developed. The method gives information on the initial temp. of a reaction and of any subsequent reaction, the formation and composition of intermediate compounds, the relative speeds of partial reactions, etc. C. R. H.

Thermal decomposition of vinyl ethyl ether. S. N. Wang and C. A. Winkler (*Canad. J. Res.*, 1943, **21**, **B**, 97—110).— $\text{CH}_2\text{:CH}\cdot\text{OEt}$ undergoes thermal decomp. at $377\text{--}448^\circ$ yielding C_2H_4 and MeCHO according to a first-order equation with velocity coeff. $4.0 \times 10^{-11} e^{-44,400/RT}$ sec.⁻¹. The reaction sensitises the decomp. of MeCHO and the polymerisation of C_2H_4 , indicating that free radicals are formed. NO has no effect on the rate of decomp. of $\text{CH}_2\text{:CH}\cdot\text{OEt}$ but inhibits the sensitised decomp. of MeCHO . It is suggested that the decomp. of $\text{CH}_2\text{:CH}\cdot\text{OEt}$ occurs through a rearrangement mechanism in which an α -H of the Et group passes to the α -C of the vinyl group with simultaneous rupture of the C-O linking. Free radicals do not play an important part possibly owing to the inhibiting character of the unsaturated ether. J. W. S.

Measurement of reaction velocities and determination of smallest quantities of catalytic substances by a potentiometric method I. Iodine. F. L. Hahn and M. Adler (*Proc. 8th Amer. Sci. Congr.*, 1942, **7**, 169—175).—Sandell and Kolthoff's method (A., 1934, 856) is used. F. R. G.

Kinetics of chain polymerisation. IX. Induction of polymerisation reactions by free radicals. G. V. Schultz (*Z. Elektrochem.*, 1941, **47**, 265—274).—Investigation of the effect of adding a small proportion of $(\text{CPh}_2\cdot\text{CN})_2$ (I) to styrene (II) and to $\text{CH}_2\text{:CMe}\cdot\text{CO}_2\text{Me}$ (III), and of $\text{CPh}_3\cdot\text{N}\cdot\text{NPh}$ (IV) to (II), shows that the polymerisation of (II) and (III) is accelerated by the free radicals produced from (I) and (IV). The polymerisation proceeds by a chain mechanism. (I) and (IV) promote the termination of the chains according to their reactivity. Comparisons of the no. of macromols. produced with the no. of free radicals present show that the kinetic chain length is equal to the mol. chain length. J. F. H.

Active oxides and reactions of solids. CXXI. Kinetics of the thermal dissociation of calcium carbonate. Kinetics of lime burning. H. Kappel and G. F. Hüttig (*Kolloid-Z.*, 1940, **91**, 117—134).—In the isothermal decomp. of CaCO_3 there is a sudden first-order reaction at points in the surface layer where there is a local rise of temp. Beneath this surface layer and separated from it by a transition layer where the reaction order is more complex, there is a region of slow decomp., the reaction being of zero order and depending on the rate of application of heat rather than on thermal conductivity or diffusion. C. R. H.

Significance of crystallographic factors in heterogeneous reactions. E. Schiebold (*Z. Elektrochem.*, 1941, **47**, 288).—Preliminary notice. J. F. H.

Equilibrium of gaseous dibromoethylenes. R. M. Noyes and R. G. Dickinson (*J. Amer. Chem. Soc.*, 1943, **65**, 1427—1429).—Gaseous equilibrium of *cis*- and *trans*- $\text{C}_2\text{H}_2\text{Br}_2$, catalysed by I, has been investigated at $144\text{--}178^\circ$. Equilibrium mixtures contain equal amounts of each isomeride; thus changes in G° , H° , and S° are all zero for the isomerisation. W. R. A.

Effect of active nitrogen and of certain nitrogen compounds on catalytic properties of carbon. P. F. Bente and J. H. Walton (*J. Physical Chem.*, 1943, **47**, 329—337).—Pure C (from lactose) was treated with N_2 , NH_3 , NO, N_2O , and $(\text{CN})_2$ at temp. $300\text{--}875^\circ$ and then used as catalyst in the decomp. of H_2O_2 , oxidation of quinone, and oxidation of K urate. NH_3 - and N_2O -treated C were the only ones which were more catalytically active, although the activity increases were not due to the presence of NH_3 or N_2O . Indeed, N_2O -treated C was almost if not entirely N_2 -free, and it is possible that N_2O oxidises C forming active surface oxides. When N_2 becomes attached to C it may be either as an association between N_2 and the ash content of the C or to attachment of N_2 to the C surface whereby new active points are created or, as in cases of inhibition, existing active points are destroyed. C. R. H.

Reactions of hydroxylamine and the catalytic oxidation of ammonia. M. Bodenstein (*Z. Elektrochem.*, 1941, **47**, 287).—Preliminary. NH_2OH , formed as the primary product in the catalytic oxidation of NH_3 , is stable at -78° , but decomposes readily in contact with solid surfaces at room temp. giving $\text{N}_2\text{O} + 2\text{NH}_3 + 3\text{H}_2\text{O}$; above 200° NO , N_2 , H_2O , and NH_3 , but no N_2O , are produced. N_2O is the main product when NH_2OH vapour and O_2 are circulated over a $\text{Fe}_2\text{O}_3\text{--Bi}_2\text{O}_3$ catalyst at 200° . This supports the assumed reaction $\text{NH}_2\text{OH} + \text{O} \rightarrow \text{HNO} + \text{H}_2\text{O}$. The reaction $\text{NH}_2\text{OH} + \text{NH}_3 \rightarrow \text{N}_2 + \text{H}_2\text{O} + 2\text{H}_2$ is shown not to occur. J. F. H.

Catalytic hydrogenation rates.—See B., 1943, II, 305.

Fluid catalyst process. Catalytic cracking of petroleum.—See B., 1943, I, 394.

[Catalytic] hydrogenation of some sulphur compounds.—See B., 1943, II, 305.

Effect of surface on cathode polarisation during electrodeposition of copper.—See B., 1943, I, 415.

Nature of latent images formed in photographic emulsions due to light absorption and to the passage of ionising particles. D. M. Bose (*Indian J. Physics*, 1943, **17**, 27—37).—The effect of photons on photographic emulsions takes place from the surface inwards, but that of ionising particles is a vol. effect working from the inside of the Ag halide grains to the outside. Hence emulsions with large grains will be more sensitive than fine-grained emulsions for photons, and the reverse for ionising particles. The increase in sensitivity of fine-grained emulsions in the case of ionising particles brought about by optical desensitisers is discussed. Such desensitisers destroy surface-sensitive spots and give greater prominence to internal latent images. Ag halide grains in an emulsion possess different degrees of sensitiveness, both to photons and to ionising particles. An expression is deduced for the no. of Ag grains deposited along the track of ionising particles. A. J. M.

Apparatus for photolysis studies in the gas phase. I. Acetone and iodine mixtures. S. W. Benson and G. S. Forbes (*J. Amer. Chem. Soc.*, 1943, **65**, 1399—1405).—A continuous-flow apparatus has been used to investigate the photolysis in the gas phase of COMe_2 and $\text{COMe}_2\text{--I}$ mixtures by λ 2537 Å. at $60\text{--}140^\circ$. When I is absent, the main products are C_2H_6 and CO with some CH_4 and Ac_2 , but when I is present the main products are CO and MeI with traces of AcI and CH_4 . The primary process (quantum efficiency ~ 1) is the decomp. of COMe_2 to Me and Ac radicals, at least 22% of the latter decomp. into Me and CO . Simultaneous formation of CH_4 and COMeEt in the photolysis of COMe_2 is suggested. Activation energies for decomp. of Ac and the formation of AcI from Ac radicals and I are 16 and 9 kcal. per mol. W. R. A.

Flash saturation and reaction periods in photosynthesis. F. F. Rieke and H. Gaffron (*J. Physical Chem.*, 1943, **47**, 299—308).—In the flashing light method for studying photosynthesis the intervals between successive flashes were made of unequal length, the average intensity remaining the same. With this modification there is, between one pair or group of closely spaced flashes and the next pair or group, a dark interval during which the rate-limiting reaction has time to recover. The method has been applied to CN' -inhibited photosynthesis and to the photo-reduction of CO_2 . In the former case it is shown that the reaction responsible for flash saturation is insensitive to CN' , the action of CN' being to limit some other reaction, possibly connected with the initial fixation of CO_2 . In the latter case it is shown that the length of the dark interval necessary to maintain flash saturation is the same as for normal photosynthesis. The data support the view that photochemical processes are unchanged whether CO_2 is reduced with O_2 evolution or with H_2 absorption. C. R. H.

IX.—PREPARATION OF INORGANIC SUBSTANCES.

Helium and rare gases. H. Damianovitch (*Proc. 8th Amer. Sci. Congr.*, 1942, **7**, 137—144).—A summary of the evidence for compound formation of He, A, and Xe with metals. F. R. G.

Existence of some transient hydrates. B. Ghosh (*J. Indian Chem. Soc.*, 1943, **20**, 120—122).—A differential thermocouple method has been employed to detect the transient formation of hydrates during dehydration of salts. L. J. J.

Reactions of the solid state. F. Feigl, L. I. Miranda, and H. A. Suter (*Anais Acad. Brasil Cienc.*, 1943, **15**, 151—186).—Experimental details are recorded for reactions between solids. Those described are CuSO_4 , $\text{Fe}_2(\text{SO}_4)_3$, MnSO_4 , NiSO_4 , or CoSO_4 with MgO ; AgI , HgCl , HgI_2 , CuI , or TlI with Zn ; formation of lakes from Al_2O_3 , MgO , BeO , TiO_2 , ZrO_2 , and ThO_2 respectively with alizarin, purpurin, quinalizarin, $\text{NO}_2\text{--C}_6\text{H}_4\text{--N}_2\text{--C}_{10}\text{H}_6\text{--OH--}\alpha$, diphenylcarbazide, or diphenylcarbazone; $\text{Ni}(\text{CN})_2$ and $(\text{CMe}_2\text{N.OH})_2$ and other substances forming complex metallic salts; AgI , PbI_2 , TlI , or CuI with MnO_2 ; WO_3 with ZnO , MgO , or CdO ; V_2O_5 with ZnO ; MoO_3 with PbO or CdO ; $\text{Mg}_2\text{P}_2\text{O}_7$ and $\text{Mg}_2\text{As}_2\text{O}_7$ respectively with MnO_2 ,

CdO , or PbO ; CdO or PbO with SiO_2 ; WO_3 or MoO_3 with $\text{Ca}_3(\text{PO}_4)_2$; PbSO_4 with BaCO_3 ; CuI with ZnO ; $\text{Hg}(\text{CN})_2$ or AgCN with Se ; Ag_2CrO_4 with TlI ; CuI or AgI with HgI_2 . F. R. G.

Mercuri-iodides. M. Meyer (*J. Chem. Educ.*, 1943, **20**, 145—146).— Ag^+ , Pb^{2+} , Hg^+ , Cu^{2+} , Bi^{3+} , and Cd^{2+} , of the usual 24 ions of qual. analysis, yield ppts. when K_2HgI_4 is added to solutions of the metal salt. Ag_2HgI_4 , ρ_4^{25} 6.02, an amorphous yellow powder at room temp., changes reversibly at 51.2° to an orange modification; it darkens on exposure to light. The Pb compound, probably $\text{Pb}(\text{OH})_2 \cdot 3\text{PbHgI}_4$, ρ_4^{25} 6.16, is an amorphous orange-red powder, transition temp. to yellow modification at 133.8° . HgHgI_3 , ρ_4^{25} 6.92, an amorphous yellow-orange powder, is photosensitive; transition temp. are: to red $>160^\circ$, to orange-red at 172.6° , and to deep-red at 220.1° , m.p. 224.4° . Cu_2HgI_4 , ρ_4^{25} 5.97, is a micro-cryst. red powder; transition temp., 66.6° to a purple-brown modification. Addition of K_2HgI_4 to Bi^{3+} gives first HgI_2 , then a purplish-black, micro-cryst. basic salt with no transition temp. up to 300° . Cd^{2+} gives a ppt. of HgI_2 with K_2HgI_4 . The Cu and Ag compounds sealed into narrow-bore glass tubing to make coloured stirring-rods showed rapid and brilliant colour changes when placed alternately in hot and cold solutions. L. S. T.

Standardisation of activity of aluminium oxide for chromatography. P. B. Müller (*Verh. Ver. Schweiz. Physiol.*, 1942, **21**, 29—31).—The heat evolved in treating Al_2O_3 with solvents (light petroleum) is reproducible and \propto its chromatographic adsorption activity. When active and inactive products are mixed, the relation between content of active Al_2O_3 and evolution of heat is complex and dependent in a non-linear manner on the composition of solvent mixtures, but products of any desired degree of activity may be obtained by mixing with reference to preconstructed curves. With sensitive adsorbates, the lowest practicable adsorption activity is recommended. A. H. C.

Periodates of zirconium. R. K. Bahl, S. Singh, and N. K. Bali (*J. Indian Chem. Soc.*, 1943, **20**, 141—142).— $3\text{ZrO}_2 \cdot \text{I}_2\text{O}_7 \cdot 14\text{H}_2\text{O}$ and $4\text{ZrO}_2 \cdot \text{I}_2\text{O}_7 \cdot 18\text{H}_2\text{O}$ are formed by the action of Na_2 paraperiodate and K metaperiodate, respectively, on Zr nitrate. $6\text{ZrO}_2 \cdot \text{I}_2\text{O}_7 \cdot 20\text{H}_2\text{O}$ is formed by the action of paraperiodic acid on Zr hydroxide. The latter on dehydration at $<100^\circ$ gives a series of hydrates with 13, 8, 6, and 4 H_2O . L. J. J.

Reactions below 800° in powdered mixtures of lime with lead and manganese silicates used in the glass industry. J. A. Hedvall [with N. Isakson, G. Lander, and S. Pålsson] (*Z. anorg. Chem.*, 1941, **248**, 229—242).—Powdered mixtures of PbSiO_3 , Pb_2SiO_4 , and MnSiO_3 with excess of CaO were heated in air and in N_2 . The metasilicates formed double salts, CaPbSiO_4 and CaMnSiO_4 , whereas Pb_2SiO_4 reacted according to $2\text{CaO} + \text{Pb}_2\text{SiO}_4 \rightarrow \text{Ca}_2\text{SiO}_4 + 2\text{PbO}$. C. R. H.

Crystalline complexes of arsenic, antimony, and bismuth trichlorides with dioxan. C. J. Kelley and P. A. McCusker (*J. Amer. Chem. Soc.*, 1943, **65**, 1307—1309).—The compounds $2\text{AsBr}_3 \cdot 3\text{C}_6\text{H}_8\text{O}_2$, $\text{AsF}_3 \cdot \text{C}_6\text{H}_8\text{O}_2$, $2\text{SbCl}_3 \cdot 3\text{C}_6\text{H}_8\text{O}_2$, $\text{SbCl}_3 \cdot 2\text{C}_6\text{H}_8\text{O}_2$ (I), $2\text{SbBr}_3 \cdot 3\text{C}_6\text{H}_8\text{O}_2$, and $2\text{BiCl}_3 \cdot 3\text{C}_6\text{H}_8\text{O}_2$ have been prepared, and their dissociation pressures, together with that of $2\text{AsCl}_3 \cdot 3\text{C}_6\text{H}_8\text{O}_2$ (II), at 20° , and of (I) from 0° to 20° , have been determined. Complete dissociation occurs with all dioxanates in C_6H_4 solution and with (II) in the vapour phase. W. R. A.

Niobates and tantalates. F. Windmaisser (*Z. anorg. Chem.*, 1941, **248**, 283—288).—K tantalates and niobates have been prepared by fusing K_2CO_3 or KOH with Ta_2O_5 and Nb_2O_5 . Examination of the products has demonstrated the existence of $4\text{K}_2\text{O} \cdot 3\text{Ta}_2\text{O}_5 \cdot 16\text{H}_2\text{O}$ and $7\text{K}_2\text{O} \cdot 5\text{Ta}_2\text{O}_5 \cdot 24\text{--}30\text{H}_2\text{O}$, which are very similar in lattice structure. The existence of the corresponding niobates was demonstrated, although $7\text{K}_2\text{O} \cdot 5\text{Nb}_2\text{O}_5 \cdot x\text{H}_2\text{O}$ was obtained only occasionally. C. R. H.

Sulphur monoxide. VIII. Decomposition of sulphur monoxide. Polysulphur oxides. P. W. Schenk (*Z. anorg. Chem.*, 1941, **248**, 297—312).—Mol. wt. data and vol. contractions observed on decomp. of gaseous SO indicate a mol. wt. of ~ 70 and show that it is either a mixture of $(\text{SO})_2$ and SO , or a mixture of S_2O and SO_2 formed according to $3\text{SO} \rightarrow \text{S}_2\text{O} + \text{SO}_2$. A new investigation of the decomp. of liquid SO confirms earlier conclusions (cf. A., 1937, I, 576) that it contains polysulphur oxides of the formula S_nO_{n-2} ($n < \infty$). CS_2 , CHCl_3 , and CCl_4 solutions of SO show evidence of polymerisation, mol. wts. of 720—930 in CCl_4 having been obtained. C. R. H.

Amides of tervalent chromium and cobalt. O. Schmitz-Dumont (*Z. Elektrochem.*, 1941, **47**, 221—222).—Chromic and cobaltic amides have been prepared from KNH_2 and $[\text{Cr}(\text{NH}_3)_6](\text{NO}_3)_3$ or $[\text{Co}(\text{NH}_3)_6](\text{NO}_3)_3$ in liquid NH_3 under pressure. They retain no bound NH_3 at 0° and are amorphous solids of empirical formulae $\text{Cr}(\text{NH}_2)_3$ and $\text{Co}(\text{NH}_2)_3$, apparently highly polymerised into long chain-like mols. with each metal atom surrounded by 6 NH_2 -groups. These amides resemble one another more than the corresponding hydroxides. $[\text{Cr}(\text{NH}_2)_3]_n$ is bright pink, dissolves in H_2O without depressing the f.p. to give a red solution, and slowly hydro-

lyses. It does not give triaquotriammine salts with dil. acids, and is amphoteric in liquid, NH_3 giving (i) a deep red solution with NH_4Br containing isolatable $[\text{Cr}(\text{NH}_3)_3.\text{NH}_4\text{Br}.\text{HBr}]_n$ and (ii) $K_n[\text{Cr}(\text{NH}_3)_4]_n$ with KNH_2 . $[\text{Cr}(\text{NH}_3)_4]\text{I}_3$ and excess of KNH_2 give $K_n[\text{HNCr}(\text{NH}_3)_2]_n$. Thermal decomp. of chromamide to CrN gives HNCrNH_2 , and probably $\text{HN}[\text{Cr}(\text{NH}_3)_2]_2$ and $\text{Cr}_2(\text{NH}_3)_3$ as intermediates. $[\text{Co}(\text{NH}_3)_3]_n$ is brown and likewise amphoteric in liquid NH_3 , giving (i) a dark brown solution with NH_4NO_3 containing $[\text{Co}(\text{NH}_3)_3.\text{NH}_4\text{NO}_3]_n$, and (ii) a reaction with KNH_2 , the amido-salt initially formed evolving NH_3 spontaneously to give the black $\text{Co}_2(\text{NK})_3$.
L. H. L.

Affinity. XCIX. Phosphides of tungsten, molybdenum, and chromium. F. E. Faller and W. Biltz [with K. Meisel and M. Zumbusch] (*Z. anorg. Chem.*, 1941, 248, 209—228).—Phosphides of W, Mo, and Cr have been prepared by heating the powdered metals with white P. Only two stable W phosphides were obtained, WP_2 and WP , W_3P_4 having been shown to be a two-phase system and W_2P being a mixture of WP and W. Amorphous, labile W_4P decomposes into W + WP and not into W + W_2P . The stable Mo and Cr phosphides are MoP_2 , MoP , and Mo_3P , and CrP_2 , CrP , Cr_2P , and Cr_3P . There is no evidence of Cr_2P_3 . The heats of formation of WP_2 , MoP_2 , and CrP_2 from monophosphide and yellow P are 12, 10, and 6.5 kg.-cal., respectively. The increments of mol. vol. due to P have been calc. from d data for each compound.
C. R. H.

Reduction of ferric oxide by hydrogen. F. Olmer (*J. Physical Chem.*, 1943, 47, 317—325).—The author's method for studying reactions (cf. A., 1943, I, 280), applied to the reduction of Fe_2O_3 and magnetic Fe_3O_4 in H_2 , shows that Fe_2O_3 is reduced to Fe_3O_4 below 325° and directly to Fe above 325° , no Fe_3O_4 or FeO being formed. Fe_3O_4 is directly reduced to Fe without formation of FeO.
C. R. H.

Metal carbonyls. XXXVII. Ease of formation and properties of rhenium halogenopentacarbonyls. W. Hieber, R. Schuh, and H. Fuchs. **XXXVIII. Rhenium pentacarbonyl. XXXIX. Amine-substituted rhenium carbonyls.** W. Hieber and H. Fuchs (*Z. anorg. Chem.*, 1941, 248, 243—255, 256—268, 269—275).—XXXVII. The ease of formation of $\text{Re}(\text{CO})_5\text{X}$ ($\text{X} = \text{Cl}, \text{Br}, \text{I}$) from K_2ReX_6 and CO decreases in the order $\text{I} > \text{Br} > \text{Cl}$, a temp. of $\sim 230^\circ$ and a CO pressure of ~ 30 atm. being necessary to form $\text{Re}(\text{CO})_5\text{Cl}$, whereas $\text{Re}(\text{CO})_5\text{I}$ is formed at atm. pressure. $\text{Re}(\text{CO})_5\text{X}$ is also formed from CO, Re, and NiX_2 or CuX_2 , and from CO, KReO_4 , and an org. halide, at 200 — 250° and ~ 200 atm. initial CO pressure. The order of stability towards reagents is $\text{Cl} > \text{Br} > \text{I}$. Cl_2 and Br liberate I from $\text{Re}(\text{CO})_5\text{I}$.

XXXVIII. $[\text{Re}(\text{CO})_5]_2$ (I) (m.p. 177°) has been prepared by the interaction of CO and Re_2O_7 or KReO_4 at 250° and 350 atm. or at 270° and 500 atm. effective pressure, respectively. Re_2S_7 and CO at $240^\circ/250$ atm. also afford (I); in presence of H_2 or H_2O small quantities of a volatile Re compound, probably a Re carbonyl hydride $[\text{ReH}(\text{CO})_5]_2$, are also formed. (I) belongs to the monoclinic prismatic system, with $a : b : c$ 1.045 : 1 : 2.045, $\beta = 76^\circ 28'$. (I) reacts with X_2 to form $\text{Re}(\text{CO})_5\text{X}$.

XXXIX. By heating $\text{Re}(\text{CO})_5\text{X}$ or $[\text{Re}(\text{CO})_5]_2$ with $\text{C}_5\text{H}_5\text{N}$ or *o*-phenanthroline the following 8 compounds have been prepared: $\text{Re}(\text{CO})_3(\text{C}_5\text{H}_5\text{N})_2\text{X}$, $\text{Re}(\text{CO})_3(\text{C}_5\text{H}_5\text{N})_2$, $\text{Re}(\text{CO})_5\text{C}_{12}\text{H}_8\text{N}_2\text{X}$, $\text{Re}(\text{CO})_5\text{C}_{12}\text{H}_8\text{N}_2$. The non-halogenated compounds are probably dimeric.
C. R. H.

X.—ANALYSIS.

Elementary spark spectrum analysis. C. C. Kiplinger (*J. Chem. Educ.*, 1943, 20, 234).—Laboratory apparatus suitable for qual. analysis is described.
L. S. T.

Systematic indirect analysis. II. Further development to indirect volumetric analysis. P. Fuchs (*Z. anal. Chem.*, 1941, 121, 305—347).—A review of principles involved in the application of the methods of indirect volumetric analysis to mixtures of several components.
L. S. T.

Sensitivity of chemical reactions. II, III. A. Schleicher (*Z. anal. Chem.*, 1941, 121, 183—186, 187—189; cf. A., 1943, I, 262).—Theoretical.
L. S. T.

Drop reaction experiments. I. Catalytic reactions. II. Reaction on filter-paper. III. Heterogeneous reactions. F. Feigl (*J. Chem. Educ.*, 1943, 20, 137—141, 174—178, 240—243).—I. Experiments are described showing the following: the catalysis of the I_2 — NaN_3 reaction by S^{2-} ; the autocatalysis of the KMnO_4 — $\text{H}_2\text{C}_2\text{O}_4$ reaction; the formation of HNO_2 during the reduction of aq. KNO_3 by Zn and dil. HCl in presence of KI; the acceleration by NO_3^- of the reduction of KMnO_4 by H from Zn and H_2SO_4 ; the prevention of the oxidation of Mo-blue by conc. HNO_3 in presence of $\text{CO}(\text{NH}_2)_2$, due to destruction of HNO_2 by $\text{CO}(\text{NH}_2)_2$; and the prevention of the oxidation of KCNS to K_2SO_4 by HNO_3 in presence of NaN_3 , which again destroys HNO_2 as soon as it is formed.

II. The following reactions on filter-paper are described and discussed: union of S or Se with Ti_2S to form $\text{Ti}_2\text{S}_2\text{S}_2$ or $\text{Ti}_2\text{S}_2\text{Se}_2$,

respectively (limits of identification, 3 μg . of S or 1 μg . of Se per drop); reaction of finely-divided MnO_2 with dil. HCl, dil. H_2SO_4 , AcOH, and reducing agents; reaction of HgO with NH_4OH , HCl in two stages; oxidation of S to SO_4^{2-} by I; conversion of metal sulphides, e.g., Ti_2S , HgS , PbS , into the corresponding iodides; and the reaction of HgS with alkali polyiodide, which is now shown to proceed according to the schemes $\text{HgS} + \text{I}_2 = \text{HgI}_2 + \text{S}$, and $\text{HgI}_2 + 2\text{KI} = \text{K}_2\text{HgI}_4$. Owing to the much greater dispersion of a ppt. formed on paper many effects, hitherto unknown, have been observed and can be demonstrated in some of the above reactions.

III. Experiments illustrating (i) the condensation and reaction of H_2 + air or illuminating gas + air on the surface of finely-divided Pt or Pd, (ii) the reaction between MnO_2 or K_2CrO_4 and dil. HCl in presence of Ag salts, and (iii) the detection of the start of pptn. reactions before the ppt. becomes visible, e.g., the reactions between $\text{Na}_2\text{S}_2\text{O}_3$ and HCl, and $\text{K}_2\text{Ni}(\text{CN})_4$ and HCl, are described and discussed.
L. S. T.

Polarographic determination of small quantities of aldehydes and [hydrogen] peroxide. See A., 1943, II, 316.

Determination of hydrogen-ion concentration in the electrolytic zinc bath.—See B., 1943, I, 416.

Determination of free acid in salts of trivalent chromium and bivalent copper.—See B., 1943, I, 401.

Ballistic method of determining the moisture content of [cellulosic] specimens.—See B., 1943, II, 314.

Electrophotometric determination of fluorine in aluminium salts.—See B., 1943, I, 401.

Determination of the concentration of industrial sulphuric acid aerosols.—See B., 1943, I, 401.

Rapid determination of sulphate in hydrogen sulphite, sulphite, and thiosulphate lyes.—See B., 1943, I, 401.

Determination of sulphur dioxide in presence of nitrogen oxides.—See B., 1943, I, 401.

Quantitative X-ray analysis [determination] of selenium.—See B., 1943, I, 402.

Determination of residual nitrogen in the inert gases. G. Heyne, E. Hille, and F. Schaefer (*Z. anal. Chem.*, 1941, 121, 411—419).— N_2 ~ 0.01 vol.-% in the inert gases is fixed either as Mg_3N_2 using an electric arc between Mg electrodes and determining the N as NH_3 , or as oxides of N in a spark discharge. The N oxides are absorbed in alkali and the NO_2^- is determined colorimetrically by the Griess-Ilosvay reaction, or as NH_3 after reduction by Devarda's alloy. Procedure for analysing NO_3^- or NO_2^- — NO_3^- mixtures colorimetrically after reduction of the NO_3^- by Pb powder is described.
L. S. T.

Determination of nitrogen in alloys containing chromium.—See B., 1943, I, 414.

Unreliability of resorcinol-periodate test for hyponitrites. W. V. B. Sundara Rao and V. V. K. Sastry (*J. Indian Chem. Soc.*, 1942, 19, 188).—At pH 1—3 a red colour is given also by NH_4OH and NO_2^- ; at pH 7—8 the colour is pink (given also by B_4O_7 , HCO_3^- , and NO_3^-). The production of the colour is unaffected by the buffers, by excess of NaCl, or by varying the concn. of resorcinol or the order of addition of the reagents (cf. Corbet, B., 1940, 709).
J. H. BA.

Determination of phosphoric acid by weighing magnesium ammonium phosphate. P. Lederle (*Z. anal. Chem.*, 1941, 121, 241—254).—The ppt. obtained from PO_4^{3-} and Mg^{2+} in presence of NH_4Cl and aq. NH_3 can be weighed directly after washing with dil. NH_3 and anhyd. COMe_2 , and drying for 10 min. in a vac. desiccator. An empirical factor, 0.2759 instead of 0.2894 for $\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$, must be used to obtain the P_2O_5 content. With citric acid extracts of basic slag, the factor becomes 0.2788 (mean of 100 determinations). The method can also be used in the determination of Mg. L. S. T.

Rapid colorimetric determination of phosphorus in iron alloys in presence of arsenic.—See B., 1943, I, 411.

Volumetric determination of boric acid. I, II. H. Schäfer and A. Sieverts (*Z. anal. Chem.*, 1941, 121, 161—169, 170—183).—I. Metals interfering with the usual titration of H_3BO_3 are removed by pptn. with 8-hydroxyquinoline (I) dissolved in dil. NaOH. Excess of (I) is removed by means of aq. MgCl_2 and animal C. Normal amounts of alkali and alkaline-earth metals need not be removed. Data showing satisfactory recoveries of H_3BO_3 in presence of Zn, Pb, Al, Fe, or Ni are recorded.

II. Methods for titrating aq. H_3BO_3 with CO_2 -free alkali in presence of invert sugar or mannitol, using Me-red or bromocresol-purple as indicator, are described. Data showing that the invert sugar method is not interfered with by NH_4^+ , Zn^{2+} , Ni^{2+} , Cd^{2+} , Co^{2+} , Mn^{2+} , AsO_3^{3-} , and small amounts of SiO_2 , $n\text{H}_2\text{O}$, H_3PO_4 , and H_3AsO_4 are given; Al^{3+} , Fe^{3+} , and Pb^{2+} must be previously removed by means of (I). Large amounts of SiO_2 can be eliminated, without loss of (I).

BO_3''' , as SiO_2 gel under the conditions described. Application to the determination of H_3BO_3 in silicates is outlined. L. S. T.

Perchloric acid method of determining silica in Portland cement and its raw materials.—See B., 1943, I, 408.

Determination of free carbon (graphite) in carborundum.—See B., 1943, I, 401.

Determination of carbon dioxide in soap and soap products by loss in weight.—See B., 1943, II, 323.

Determination of small amounts of calcium oxide in chromate solutions.—See B., 1943, I, 401.

Rapid determination of magnesium with oxine in aluminium alloys.—See B., 1943, I, 418.

Determination of magnesium in aluminium alloys.—See B., 1943, I, 418.

Potassium mercuric thiocyanate in microchemical technique. D. Gramacho (*Rev. Brasil. Quím.*, 1943, 15, 269—274).— $\text{K}_2\text{Hg}(\text{CNS})_4$ is suitable for the photomicro-detection of Zn, Ni, Cu, Cd, and Co in presence of each other in minerals, except when Zn and Cd are present in similar proportions. When present singly, 22 μg . of Zn, 20 μg . of Co, 41 μg . of Ni, 25 μg . of Cu, and 31 μg . of Cd per c.c. can be detected. F. R. G.

Rapid determination of small amounts of zinc.—See B., 1943, I, 416.

Determination of cadmium as cadmium sulphide. I. Sarudi (v. Stetina) (*Z. anal. Chem.*, 1941, 121, 348—350).—Cd sulphide pptd. by H_2S from hot sulphate solutions containing initially 30 c.c. of conc. H_2SO_4 per l. has the theoretical composition when the $[\text{Cd}^{++}]$ is >0.2 g. per l. Such a solution is treated, while cooling, with H_2S for 45 min., diluted by half its vol. of cold H_2O , and treated with H_2S again for 20 min. The ppt. is washed with cold H_2O , EtOH , and Et_2O , dried at 100° , and weighed. Test data are recorded. L. S. T.

Rapid determination of copper in very poor ores and flotation tailings.—See B., 1943, I, 415.

Rapid determination of small amounts of copper in high-grade antimony metal.—See B., 1943, I, 417.

Determination of aluminium by precipitation with phenylhydrazine. W. C. de Moraes Bastos (*Publ. Inst. Nac. Tecn., Rio de Janeiro*, 1942, 54 pp.).—Al is determined as Al_2O_3 by pptn. with $\text{NHPh}\cdot\text{NH}_2$. In presence of large amounts of Fe and Mn, and small amounts of P, Ti, Zr, Ca, Mg, Zn, Co, and Cu, the error in the determination of Al is $>0.5\%$. In Mn minerals TiO_2 and P_2O_5 are pptd. with Al_2O_3 and are determined by other methods, giving Al by difference. F. R. G.

Determination of aluminium oxide in copper-aluminium alloys by wet chlorination.—See B., 1943, I, 418.

Potentiometric determination of aluminium in silicate ores.—See B., 1943, I, 417.

Identification and determination of small quantities of permanganate in presence of large amounts of chromate. F. Feigl and H. Sutter (*An. Assoc. Quím. Brasil*, 1943, 2, 1—4).—Quantities <0.3 μg . of KMnO_4 in 0.05 ml. can be determined in presence of 0.02 g. of K_2CrO_4 by its coloration of filter-paper in comparison with a standard test. The method is rapid and requires little material. F. R. G.

Diphenylmethylamine-*p*-sulphonic acid as redox indicator [in the dichromate-iron titration]. J. Knop and O. Kubelková-Knopová (*Z. anal. Chem.*, 1941, 122, 183—201).— $\text{NPhMe}\cdot\text{C}_6\text{H}_4\cdot\text{SO}_3\text{H}\cdot p$ (I) (prep. of Ba and Na salts described) is more sol. in H_2O than NHPh_2 , is insensitive to $\text{WO}_3\cdot n\text{H}_2\text{O}$, and has a greater resistance to decomp. by oxidation, and hence a smaller indicator correction, than $\text{NHPh}\cdot\text{C}_6\text{H}_4\cdot\text{SO}_3\text{H}\cdot p$ (II). In dil. acid solution the colour change produced by oxidising agents is from colourless to purple-red. The colour change is induced by Fe^{++} , and is reversible. In presence of Fe^{++} , the colour appears with a min. excess of $\text{K}_2\text{Cr}_2\text{O}_7$, KMnO_4 , or $\text{Ce}(\text{SO}_4)_2$. In the $\text{Fe}\text{--}\text{K}_2\text{Cr}_2\text{O}_7$ system in 0.5—2N-acid (H_3PO_4 + H_2SO_4 or HCl), the colour change occurs at 0.51—0.59 v. in micro-titrations, or 0.52—0.63 v. in macro-titrations. The indicator is very sensitive; the first perceptible red colour appears at a $[\text{K}_2\text{Cr}_2\text{O}_7]$ of $2\text{--}3 \times 10^{-6}\text{N}$. Data showing the use of the indicator in macro- and micro-titrations of Fe^{++} , compared with potentiometric titrations, are recorded. In the titration of 0.05—0.2 g. of Fe by 0.05N- or 0.1N- $\text{K}_2\text{Cr}_2\text{O}_7$, the error is $+0.05\%$, so that, in general, indicator corrections are unnecessary. The $\text{K}_2\text{Cr}_2\text{O}_7$ titration of Fe^{++} after reduction of Fe^{+++} by SnCl_2 , and the back-titration of $\text{K}_2\text{Cr}_2\text{O}_7$ by Fe^{II} solution, give accurate vals. without indicator corrections. In the micro-titration of 0.4—4 mg. of Fe^{++} by 0.005 or 0.01N- $\text{K}_2\text{Cr}_2\text{O}_7$, there is an over-consumption of 0.005 c.c. of 0.01N- $\text{K}_2\text{Cr}_2\text{O}_7$ for 0.02 c.c. of 0.1% indicator solution. The micro-titration of $\text{K}_2\text{Cr}_2\text{O}_7$ by Fe^{II} solution gives accurate vals. without indicator corrections. Comparison shows the superiority of (I) over (II). The light

absorption curves of both indicators have been determined spectrophotometrically. L. S. T.

Determination of ferrous and ferric oxides in sponge iron.—See B., 1943, I, 411.

Applications of the spectrograph to steelworks analysis.—See B., 1943, I, 414.

Separation of cobalt from nickel using acetone as a solvent. M. M. Tillu (*J. Indian Chem. Soc.*, 1943, 20, 139—140).—Separation of NiCl_2 from CoCl_2 can be effected by extraction with COMe_2 , in which CoCl_2 is very sol., whilst NiCl_2 has the solubility 1 in 16,000 wt./wt. at 35° . L. J. J.

Determination of cobalt and nickel in intermediates and solid alloys based on tungsten carbides.—See B., 1943, I, 417.

Comparison of methods of determining small amounts of cobalt in ores, concentrates, and tailings.—See B., 1943, I, 417.

Analytical control of nickel-plating solutions.—See B., 1943, I, 416.

Photoelectric determination of molybdenum in steel.—See B., 1943, I, 414.

Determination of tungsten in mineral fractions and minerals by comparison of their spectral energies.—See B., 1943, I, 417.

Determination of tin by titration with methylene-blue. E. Wohlmann (*Z. anal. Chem.*, 1941, 121, 161—173).—Atack's method for determining Sn^{++} by titration with methylene-blue has been investigated and compared with the titration with I solution. Fe, which is unsuitable, and Zn, or Al have been compared as reducing agents for Sn^{++++} in HCl . WO_4^{--} , VO_4^{--} , and MoO_4^{--} interfere with the methylene-blue titration and must be absent. Any Pb, or other metal pptd. by Al during reduction of the solution containing Sn, must be removed, and the reduction repeated. Alkali, Fe, and Ni in amounts resulting from a Na_2O_2 fusion of Sn ores do not interfere. L. S. T.

Determination of tin, with special reference to tin ores.—See B., 1943, I, 416.

Determination of tin in ores and concentrates.—See B., 1943, I, 416.

Separation of tin from copper in the analysis of bronze.—See B., 1943, I, 415.

Reduction of titanate ion in the Jones reductor. L. Baumfeld (*An. Assoc. Quím. Brasil*, 1943, 2, 9—12).—Determination of Ti^{IV} by reduction with Zn-Hg (Jones), oxidation by Fe^{+++} , and titration with KMnO_4 yields results in agreement with the gravimetric method. The effect of varying the rate of reduction and other conditions is described. F. R. G.

Photometric determination of bismuth. Determination of the bismuth content of lead alloys by means of the Pulfrich photometer. K. W. Grosheim-Krysko (*Z. anal. Chem.*, 1941, 121, 399—402).—The colour that Bi^{+++} gives with $\text{CS}(\text{NH}_2)_2$ is used for the colorimetric determination of Bi^{+++} by the Pulfrich photometer. The colour is stable for <24 hr. and const. at $15\text{--}30^\circ$; the Lambert-Beer law holds. Addition of conc. tartaric solution prevents interference by the colour due to Sb^{+++} , and delays pptn. of the Pb compound with $\text{CS}(\text{NH}_2)_2$. Procedure and test data for determining 0.01—0.8% of Bi in Pb are given. L. S. T.

XI.—APPARATUS ETC.

Simple temperature control for laboratory electric furnaces. W. Hirst and C. G. Cannon (*J. Sci. Instr.*, 1943, 20, 129—132).—The automatic furnace temp. control described uses a potentiometer bridge and a photo-cell relay unit. In addition to controlling the temp. to $\pm 1^\circ$, it will also control rate of heating. A circuit is given for the simultaneous control of a no. of furnaces by the same photo-cell unit. A. J. M.

Removal of unwanted image layer from one side of double-coated X-ray film negatives. G. W. W. Stevens (*J. Sci. Instr.*, 1943, 20, 133—134).—The gelatin layer containing the unwanted image is removed by 10% NaOCl . A method is described by which the layer can be removed from one surface without the solution coming in contact with the other. A. J. M.

Photo-electric colorimeter. II. R. Havemann (*Biochem. Z.*, 1940, 306, 224—235; cf. A., 1939, I, 389).—The apparatus and its application to the measurement of abs. vals. of light extinction, extinction coeffs. of solutions, and fluorescence are described. F. O. H.

Tension-compression device for quantitative X-ray diffraction evaluation of strain in metals and a calibrated series of aluminium alloys. G. L. Clark, G. Pish, and R. Seabury (*J. Appl. Physics*, 1943, 14, 284—290).—A simple apparatus is described for applying

tension and compression stresses to specimens under X-ray diffraction analysis. The back-reflexion technique for rapid photographing of diffraction patterns is employed. Patterns for an Al alloy under calibrated tensions are given to illustrate evaluation of residual strains in large castings without destruction. N. M. B.

Generalisation of the Bragg-de Broglie principle of rotatory focalisation for X-rays; application to two-crystal spectrographs; focalisation and mosaic structure. H. Tellez-Plasencia (*Arch. Sci. phys. nat.*, 1943, [v], 25, 35—54).—An extension of the focalisation conditions. The condition of symmetry or equidistance of the collimator and film relative to the crystal is not necessary. For a single-crystal, focalisation is obtained when the angular velocities of the collimator and film vary inversely as their respective radii. Focalisation thus becomes possible with a crystal used in transmission, or with two crystals, and angular apertures of the incident beam allowing strong illumination can be used. An analogous arrangement allows rays dispersed by a mosaic crystal to be regrouped, and the loss of power due to crystal imperfections to be eliminated. N. M. B.

Visual observations in the infra-red.—See B., 1943, II, 319.

Plate calibration problems. R. A. Sawyer and H. B. Vincent (*J. Opt. Soc. Amer.*, 1943, 33, 247—251).—Neutral filters made by thermal evaporation of Sb on to quartz plates in vac. are suitable for light intensity-density calibration of photographic emulsions. The importance of checking self-consistency of calibration curves and avoidance of errors due to reciprocity law failure is emphasised. L. J. J.

Wave-length calibration of spectrophotometers. J. A. Van den Akker (*J. Opt. Soc. Amer.*, 1943, 33, 257—259).—A method of finding effective $\lambda\lambda$ for spectrophotometers by the use of filters is described. L. J. J.

Theory of the electrostatic β -particle energy spectrograph. H. F. T. Rogers, jun., and C. W. Horton (*Rev. Sci. Instr.*, 1943, 14, 216—220; cf. A., 1940, I, 176).—An extension of Dempster's theoretical discussion of the electrostatic analyser. W. R. A.

Vibrating slide as an aid to electron-microscopy and microscopy. M. von Ardenne (*Kolloid-Z.*, 1940, 93, 158—163).—The microscope slide is attached to one prong of a tuning fork which is kept vibrating at 100 cycles per sec. by means of an electromagnet. Disperse substances on the slide are thus able to dry uniformly without the particles adhering to form lumps. C. R. H.

Electrostatic electron microscope and its applications in colloid chemistry. H. Mahl (*Kolloid-Z.*, 1940, 91, 105—117).—The construction and use of the instrument are described and illustrated by micrographs. A device for taking stereo-micrographs is described. C. R. H.

Thermostatically controlled glass electrode apparatus. L. F. Le Brocq (*Chem. and Ind.*, 1943, 350—351). J. H. BA.

Effect of temperature on charged condensers. B. Gross and L. F. Denard (*An. Asoc. Quím. Brasil*, 1943, 2, 13—17).—Change of temp. of a condenser with carnauba wax dielectric at 100 v. causes a variation in charge of corresponding sign. F. R. G.

Study of band-pass effect by cathode-ray oscillograph. S. P. Chakravarti (*Indian J. Physics*, 1943, 17, 7—17).—The method given can be applied to the determination of gain or attenuation, phase-shift angle and its sign, for all types of wave-filter. Advantages and disadvantages of the oscillographic method are discussed. A. J. M.

The Geiger-Müller counter in mining technology. B. Rajewsky (*Z. Physik*, 1943, 120, 627—638).—Design and applications of a portable counter apparatus are discussed and a practical model is described. L. J. J.

Use of the Geiger-Müller counter in the search for pitchblende-bearing veins at Great Bear Lake, Canada. G. C. Ridland (*Amer. Inst. Min. Met. Eng., Tech. Publ.* 1614, 1943, 7 pp.).—The counter adapted for field use, and its operation, are described. It will detect a pitchblende ore shoot in a shear zone, and moderately radioactive host rock at a considerable distance from the ore body. L. S. T.

Combined voltage-regulating and quenching circuit for the Geiger-Müller counter. W. F. Bale and J. F. Bonner, jun. (*Rev. Sci. Instr.*, 1943, 14, 222—223). W. R. A.

Mica window Geiger counter tube for measuring soft radiations. D. H. Copp and D. M. Greenberg (*Rev. Sci. Instr.*, 1943, 14, 205—206).—The construction of the counter is described. It is as sensitive to soft radiations as a screen-walled counter, and as rapid to use as the normal metal-walled type. R. L. E.

Densitometer. J. Ciochina (*Z. anal. Chem.*, 1941, 121, 350—353).—Apparatus and method for determining the sp. gr. of liquids are described. L. S. T.

Simple semi-micro-arrangement for the kinetics of hydrogenation. P. Hersch and J. Degmer (*Rev. Fac. Sci. Istanbul*, 1942, 7, 89—

97).—An apparatus for the rapid measurement of the rate of absorption of H_2 at room pressure is figured and described. H. W.

Air-conditioned experimental cabinet. T. T. Colquhoun and V. A. Stephen (*J. Austral. Inst. Agric. Sci.*, 1943, 9, 77—80).—A cabinet of improved design is described. Humidity control is obtained by subjecting the air in the cabinet to small temp. variations over a large surface. R. H. H.

Simple accurate formula for barometric corrections. L. C. do Prado (*Rev. Sci. Instr.*, 1943, 14, 221—222). W. R. A.

Apparatus for following the course of rapid chemical reactions in solution. E. O. Powell and J. H. Trendall (*Chem. and Ind.*, 1943, 368—369).—Two opposite arms from a 4-way tap are connected with the titrating reagent whilst the third and fourth arms are connected respectively with an air supply under a slight pressure and with a fine capillary dipping into the reaction solution containing indicator. When the tap connects the third and fourth arms escaping air stirs the solution. The tap is turned through 90° and the bore, which should have a calibrated vol. of ~ 0.02 c.c., becomes filled with reagent. A further turn through 90° causes the entrapped reagent to be forced into the solution by air pressure, the entering air stirring the solution. The procedure is continued to the end-point. C. R. H.

Filtration. I. A. Brieghel-Müller (*Kolloid-Z.*, 1940, 93, 297—318).—The theory of filtration is developed on the basis of Poiseuille's law. With turbulent flow, the initial resistance to flow is lowered. The resistance is also affected by the packing of the filter-cake and differences in the size and shape of the filtered particles. The effect of these factors on the rate of flow is investigated theoretically, and apparatus is described by which it can be determined. A. J. M.

New method for determination of viscosity for high shearing stresses and definite shearing velocities. I. F. Wachholtz and W. K. Asbeck (*Kolloid-Z.*, 1940, 93, 280—297).—Theories of flow of true and anomalous liquids, and methods of determining η , are summarised. Three types of viscometer were investigated for the determination of η at various shearing velocities for pigment-oil suspensions. A rotating-disc viscometer gives bad results owing to frictional temp. rises. A falling-sphere viscometer with a narrow space between sphere and wall of vessel showed that small quantities of suspended pigment favoured turbulent flow. A band viscometer with a horizontal band was constructed to fulfil the requirements of an ideal viscometer. Such an instrument is suitable for the determination of η of suspensions for high rates of shear. A. J. M.

Making crystal models. D. J. Fisher (*Amer. Min.*, 1943, 28, 54).—An alternative method for deriving the edges is presented (cf. *ibid.*, 1941, 26, 718). L. S. T.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Laboratory experiment on deliquescence and efflorescence. O. F. Steinbach (*J. Chem. Educ.*, 1943, 20, 146). L. S. T.

Chemical philosophy of Thomas Sterry Hunt. E. R. Atkinson (*J. Chem. Educ.*, 1943, 20, 244—245). L. S. T.

Carl Julius Fritzsche and the discovery of anthranilic acid, 1841. F. E. Sheibley (*J. Chem. Educ.*, 1943, 20, 115—117). L. S. T.

Robert Child's chemical book list of 1641. W. J. Wilson (*J. Chem. Educ.*, 1943, 20, 123—129). L. S. T.

John Griscom, chemist, 1774—1852. E. F. Smith (*J. Chem. Educ.*, 1943, 20, 211—218). L. S. T.

XIII.—GEOCHEMISTRY.

Distribution of atmospheric ozone. O. R. Wulf (*Proc. 8th Amer. Sci. Congr.*, 1942, 7, 439—446).—Variations in the O_3 content of the atm. are partly explicable by air currents in the stratosphere arising from observed differences in temp., which is highest over the poles. Other factors influencing O_3 distribution are discussed. F. R. G.

Fluorinated waters. J. E. Muñoz (*Proc. 8th Amer. Sci. Congr.*, 1942, 7, 203—207).—10 Bolivian sources of H_2O containing F are described. F. R. G.

Helium age measurement. I. Preliminary magnetite index. P. M. Hurley and C. Goodman (*Bull. Geol. Soc. Amer.*, 1943, 54, 305—323).—He, Ra, and Th contents of magnetite separated from numerous magnetic rocks of various age are recorded and discussed. The He age measurements show a grouping and sequence in accordance with geological knowledge. Ages ($\times 10^6$ years) are: mean Miocene 19; mean Laramide 57; mean Nevadan 118; mean late Triassic 155; mean late Appalachian 215; mean Devonian 348; pre-Cambrian 500—1650. The scale is suitable as an index for the

preliminary investigation of the He-retentivity of minerals. Age measurements made directly on samples of igneous rocks are unsuccessful owing to the leakage of He from most of the common minerals.

L. S. T.

Helium retention in common rock minerals. P. M. Hurley and C. Goodman (*Bull. Geol. Soc. Amer.*, 1941, **52**, 545–559).—Age determinations by the He method made directly on rock samples are likely to be largely in error owing to loss of He from some or all of the mineral constituents. Data obtained for pyroxene (I) and feldspar (II) from six samples of Triassic diabase show that mineral species differ in their ability to retain He; (II) loses much of its He; (I) retains more of its He than does (II), but < magnetite (III). From the general agreement between the He age ratios shown by (III) and the existing time scale indicated by the Pb method, (III) appears to retain most, if not all, of its He.

L. S. T.

Age measurements by radioactivity. C. Goodman and R. D. Evans (*Bull. Geol. Soc. Amer.*, 1941, **52**, 491–544).—The various radioactive age methods, particularly the He method, are critically reviewed. The retentivity of rocks for He is the main uncertainty in the present application of the He method. Analytical and other errors necessitate discarding much of the previous work on age determinations. Isotopic abundance measurements are essential in the determinations of ages by the Pb method. The Pb and He methods are still the most promising for quant. age determination.

L. S. T.

Phosphate deposits in New Guinea. R. C. Hutchinson (*New Guinea Agric. Gaz.*, 1941, **7**, 239–248).—Two native sources of phosphate are described, one a rock phosphate containing 10.0–11.7% P_2O_5 , the other from bat caves containing guano deposits.

T. W. P.

Phosphatisation at Malpelo Island, Colombia. D. McConnell (*Bull. Geol. Soc. Amer.*, 1943, **54**, 707–715).—Three specimens from Malpelo have been examined petrographically. Two show appreciable alteration by phosphatic solutions from guano; one is an amygdaloid in which the feldspars have been completely destroyed and replaced, and the other is a phosphate rock composed essentially of phosphosiderite and strengite, a dimorphous pair with the composition $FePO_4 \cdot 2H_2O$.

L. S. T.

Identification of the opaque minerals by electrochemical methods. D. V. Dodge (*Amer. Min.*, 1943, **28**, 103–109).—The effects of electrolysis a drop of a standard etching reagent while it is in contact with a polished surface of the "insol." mineral are observed. Some minerals, e.g., cassiterite, franklinite (I), sphalerite, and chalcopyrite, dissolve readily, and microchemical tests can be applied to the solution. Others stain readily and can be recognised; thus, intergrowths of (I) and magnetite can be distinguished, and hematite can be differentiated from ilmenite. Details of apparatus, and the behaviour of various minerals towards different reagents, are described.

L. S. T.

Composition of some calcareous rocks of the São Roque series. B. A. Ferreira (*An. Assoc. Quím. Brasil*, 1943, **2**, 5–8).—Analyses are recorded for 46 samples of limestones and dolomites from the state of São Paulo.

F. R. G.

Pigeonite in the "abnormal" dolerite dykes of charnockitic areas in Mysore. P. R. J. Naidu (*Current Sci.*, 1943, **12**, 114–115).—The pigeonite is of the enstatite–diopside series $3CaMgSi_2O_6 \cdot 2Mg_2Si_2O_6$ and is present to the extent of 60 parts to 40 parts of plagioclase. It has a small optic axial angle varying from almost uniaxial to $2V = 13^\circ$ and 18° ; the mineral is described.

F. R. G.

Effect of chemical impurities on scheelite fluorescence. R. Greenwood (*Econ. Geol.*, 1943, **38**, 56–64).—Spectrographic analyses of 54 samples of scheelite (I) show the almost invariable presence of Si, Al, Fe, and Mg, in addition to Ca and W. Most samples contain Mo, Mn, and Cu. Sr, Y, and Yb occur frequently, and Pb, Ag, As, Bi, and Ti occasionally; Yb is always accompanied by Y. The presence of Mo, and, to a smaller extent, of Mn, is characteristic of all samples that fluoresce yellow, the Mo content of (I) increasing from a trace in those that fluoresce blue to a max. in those that fluoresce yellow. Mn acts similarly, but the other elements showed no systematic variation.

L. S. T.

X-Ray petrology of some fine-grained foliated rocks [slate and shale]. H. W. Fairburn (*Amer. Min.*, 1943, **28**, 246–256).

L. S. T.

Large and small garnets from Fort Wrangell, Alaska. A. Pabst (*Amer. Min.*, 1943, **28**, 233–245).—Measurements of 133 garnets from this locality show good correlation of habit with size.

L. S. T.

Xenolithic minor intrusion at Slievenagriddle, Co. Down. E. M. Patterson (*Geol. Mag.*, 1942, **79**, 297–311).—Chemical and spectrographic analyses are recorded; they establish the order of geochemical migration for the alkali metals.

L. S. T.

Igneous rocks from the Central Libyan desert. S. I. Tomkeieff and R. F. Peel (*Quart. J. Geol. Soc.*, 1942, **98**, 223–234).—Petrographical. Chemical analyses of the younger igneous rocks are recorded and discussed.

L. S. T.

Ranciéite, a valid mineral species. W. E. Richmond and M. Fleischer (*Amer. Min.*, 1942, **27**, 231).—Ranciéite (I), usually regarded as a variety of psilomelane, is a distinct species. (I) from Cuba has the formula $(Ca, Mn)O_4MnO_2 \cdot 3H_2O$; most of the H_2O is lost at $<250^\circ$, with the formation of a new phase.

L. S. T.

Sphalerite–dolomite orientation relations. F. Robertson (*Amer. Min.*, 1942, **27**, 232).—Orientation of dolomite (I) and metasomatic sphalerite in two coarsely cryst., slightly foliated (I) specimens from the Renfrew Zinc Prospect, Ontario, is described.

L. S. T.

Order of silicates in systematic mineralogy. A. F. Rogers (*Amer. Min.*, 1942, **27**, 232).—Discrete SiO_2 silicates (orthosilicates) should come first, and the network silicates (polysilicates) last.

L. S. T.

Extreme hydrothermal alteration in the Buck Creek, N. Carolina, dunite body. C. S. Ross (*Amer. Min.*, 1942, **27**, 233).—All variations between pure olivine (I) dunite and rocks in which (I) has been completely replaced are present. Alteration has resulted from the introduction of hydrothermal solutions which introduced Al_2O_3 and CaO, and removed MgO.

L. S. T.

Rarer metallic constituents of some American igneous rocks. I, II. E. B. Sandell and S. S. Goldich (*J. Geol.*, 1943, **51**, 99–115, 167–189; cf. A., 1942, I, 380).—Data showing the abundance and distribution of some of the rarer metallic constituents in igneous rocks from six regions are recorded and discussed. Numerous chemical analyses and variation diagrams are reproduced. The distribution of the minor elements is influenced by the major constituents to a marked extent. This is probably due to isomorphous replacement of the major by the minor constituents in rock-forming minerals in accordance with the principles laid down by Goldschmidt. Geological factors are also of importance in determining the behaviour of the minor as well as of the major constituents. Estimates of the probable abundance of the minor elements in the earth's crust are given. In the Kearsage and Greenstone flows of Michigan, Ni and Co show a close relationship to MgO and CaO, and Cu and Zn appear to be related to the distribution of Fe. With the exception of the Michigan Cu district, the Cu content of the igneous rocks from Minnesota is 3 to 4 times that of similar rocks from other regions. The marked similarities in the bulk chemical analyses of the granitic rocks from the St. Francois Mts. of Missouri and from the Llano uplift of Texas are reflected in the heavy metal (Pb, Zn, Cu, Ni, and Co) contents of these rocks. Cu, Pb, and Zn contents of 10 rocks from Clear Lake area, California, give unusually smooth curves. Analyses of a granite from the White Mountain district of New Hampshire and of a Na_2O -amphibole separated from it show that all the Zn, but only small fractions of the Cu and Pb, present in the granite can be accounted for by the amphibole. Mo and Be show a strong affinity for high- SiO_2 granites. Pb in igneous rocks shows a close relationship to K_2O , although all the Pb is not present in K minerals. Zn has a strong affinity for Fe, and enters minerals such as magnetite-ilmenite, pyroxenes, amphiboles, and biotites. Other factors, however, affect its distribution; MnO is an index element of Zn in igneous rocks. The average ratio Zn:Cu in some of the rocks studied is 500:1. Cu, like Zn, is affected by the distribution of Fe, but shows a preference for sub-silicic rocks. Cu is present chiefly as sulphide, but a high S content is not a criterion of high Cu content in an igneous rock. Ni favours basic Mg-rich rocks, and olivine is the chief Ni-bearing silicate. Co varies linearly with Mg. The ratio $Co:MgO = 0.00066:1$ can be used to predict the Co content of common igneous rocks with fair accuracy; it gives 0.0023 as the average % of Co in the igneous rocks of the earth's crust.

L. S. T.

Unit cell and space-group of claudetite. M. J. Buerger (*Amer. Min.*, 1942, **27**, 216).—Claudetite from Jerome, Arizona, is monoclinic with a_0 5.25, b_0 12.87, c_0 4.54 Å.; space-group $P2_1/n$ (C_{2h}^2), with $\sim 4 As_2O_3$ per unit cell.

L. S. T.

New mineral resembling tantalite. C. P. Guimarães (*Rev. Quím. Ind.*, 1943, **12**, 14).—The mineral containing Ta_2O_5 (90–91%), Ni_2O_3 (1–2%), Al_2O_3 (3%), and CaO (3%) occurs in pegmatite deposits in Northern Brazil. The exceptionally high Ta content indicates suitability for its extraction.

F. R. G.

Oregon's mineral industries and mineral resources. F. W. Libbey (*Bull. Geol. Soc. Amer.*, 1940, **51**, 2026–2027).—Mineral industries, in order of importance, are (i) Au (Ag), Hg, Pt (osmiridium), Cu, and Pb, (ii) sand, gravel, and crushed rock, and (iii) limestone, clay, agates, semi-precious stones, diatomite, coal, monumental stone, SiO_2 , pumice, mineral waters. Potentially valuable deposits of chromite, Fe ore, Mn, Ni, Sb, Zn, salines, marble, building stone, and peat are known. Production figures are recorded.

L. S. T.

Mineral resources of the Northwest. E. T. Hodge (*Bull. Geol. Soc. Amer.*, 1940, **51**, 2025).—Small Fe ore deposits exist. Limestone can be obtained most economically from Dall Island, Alaska. Refractory and ceramic clays occur in Lane Co., Oregon, Cowlitz Co., Washington, and Latah Co., Idaho. Large deposits of SiO_2 occur near Spokane. Magnesite for refractories and metal occurs in a large deposit near Chewelah, Washington. Numerous small

chromite deposits occur in Oregon and Washington. Occurrences of Co, Sn, W, molybdenite, and Ni are only prospective. Saline deposits are probably widespread. Large phosphate deposits occur in south-eastern Idaho. L. S. T.

Chromite in Oregon. J. E. Allen (*Bull. Geol. Soc. Amer.*, 1940, 51, 2015).—Chromite deposits occur, always in peridotite, dunite, serpentine, or associated ultrabasic rocks, in the Klamath Mountains and in the Blue Mountains. L. S. T.

Treanorite, a new mineral from Crestmore, California. A. O. Woodford, J. D. Lauder milk, and E. H. Bailey (*Bull. Geol. Soc. Amer.*, 1940, 51, 1965).—Treanorite occurs as black crystals in the pegmatites of the Commercial Quarry. It is probably monoclinic, and its composition and properties are similar to, but not identical with, those of allanite. L. S. T.

Geology and quicksilver deposits of Coso Hot Springs area. H. D. B. Wilson and N. W. Hendry (*Bull. Geol. Soc. Amer.*, 1940, 51, 1965).—Granitic rocks form the core of the Coso Range. In the Hot Springs area these are overlain by rhyolitic flows, tuffs, and breccias. Extensive hot springs and fumaroles have altered the granite and volcanic materials to opal and clay. The acidic hot springs contain unusually large amounts of sulphate, Fe, Al, and SiO₂. The Hg deposits are in another area of hot springs and fumaroles; the Hg is present as cinnabar (I) intimately associated with S and alum. (I) occurs as irregular deposits of low-grade ore in the granite and in the volcanic breccia. L. S. T.

Igneous rocks of the Highwood mountains, Montana. II. Extrusive rocks. E. S. Larsen. **III. Dykes and related intrusives.** B. F. Buie. **IV. Stocks.** C. H. Burgess. **V. Contact metamorphism.** E. S. Larsen and B. F. Buie. **VI. Mineralogy.** E. S. Larsen, C. S. Hurlbut, jun., B. F. Buie, and C. H. Burgess. **VII. Petrology.** E. S. Larsen, C. S. Hurlbut, jun., C. H. Burgess, and B. F. Buie (*Bull. Geol. Soc. Amer.*, 1941, 52, 1733—1751, 1753—1807, 1809—1828, 1829—1840, 1841—1855, 1857—1868).—Numerous chemical analyses are recorded and discussed. L. S. T.

Weathering of igneous rocks near Hong Kong. R. W. Brock (*Bull. Geol. Soc. Amer.*, 1943, 54, 717—738).—Chemical analyses of fresh and of weathered rocks are recorded, and the chemical and mineralogical changes that have resulted under the tropical but monsoon climate are discussed. Except for one lamprophyre, the rocks lie in the range of granite, syenite, and granodiorite. The order of weathering losses is CaO, Na₂O, and MgO early; SiO₂ and K₂O next; and Fe₂O₃ and TiO₂ last. H₂O is regularly added, and Fe oxidised. The chief product approximates to kaolinite. L. S. T.

Roberts Mountains, Nevada. C. W. Merriam and C. A. Anderson (*Bull. Geol. Soc. Amer.*, 1942, 53, 1675—1727).—Some chemical analyses are recorded. L. S. T.

Ring structures of the Pliny region, New Hampshire. R. W. Chapman (*Bull. Geol. Soc. Amer.*, 1942, 53, 1533—1567).—Chemical analyses of the minerals of White Mountain magma series are recorded. L. S. T.

Plagioclase twinning. R. C. Emmons and R. M. Gates (*Bull. Geol. Soc. Amer.*, 1943, 54, 287—303).—Various aspects of plagioclase twinning are discussed, and an attempt is made to use twinning as a clue to environmental conditions at the time of crystallisation. L. S. T.

Elasticity of igneous rocks at high temperatures and pressures. F. Birch (*Bull. Geol. Soc. Amer.*, 1943, 54, 263—285).—Measurements of rigidity, and the velocity of shear waves, at temp. up to 600° at pressures of 3000—9000 kg. per sq. cm. are recorded for certain igneous rocks. L. S. T.

Geology and mineralisation of the San Antonio mine, Santa Eulalia district, Chihuahua, Mexico. W. P. Hewitt (*Bull. Geol. Soc. Amer.*, 1943, 54, 173—204).—The chief yield has been Pb and Ag ore, but Sn and V ores have been produced commercially. The bodies are unusual in that Pb and V are important products from a contact-metamorphic area and that Sn occurs in replacement deposits in limestone. The Sn and V ore bodies are described. Sn is probably the last ore element introduced and may have been pneumatolytic. V ore was probably derived from the breakdown of V-bearing silicates. L. S. T.

Spectroscopic distribution of minor elements in igneous rocks from Jamestown, Colorado. J. M. Bray (*Bull. Geol. Soc. Amer.*, 1942, 53, 765—814).—Qual. and quant. spectrographic analyses of numerous igneous rocks and minerals from this district are recorded and discussed. The results show that correlation of rocks within a district is possible by use of the spectrographic method. Each rock, regardless of age, is distinguishable by variations in content of Sc, La, Ce, Nd, Er, V, Cr, Co, Ni, Pb, and Zn. Each mineral contains characteristic minor constituents which are related to the major constituents present; in general, the ions of minor elements occur

as substituents (solid solution) for ions of the appropriate-sized major elements. Sr is highest in K and Ca minerals, particularly feldspars, and Ba in K minerals. All quartz and sphenes contain Al. Sc is most abundant in Mg and Fe^{II} minerals (micas and hornblende). Sphenes contain noteworthy proportions of rare earths. Ti, Mn, V, and Cr are conc. in dark minerals and muscovite. Ni and Co occur almost exclusively in biotite. The SrO : BaO ratios decrease numerically in the order plagioclases, biotites, K-feldspars, and muscovites. Pegmatic K-feldspars have larger SrO : BaO ratios than the parent rock samples. Each pegmatic mineral averages less of almost every minor constituent than the average for the same mineral from the parent rock. This is explained by temp.-crystal structure relations. L. S. T.

Geology of the zinc-lead deposit on Calumet Island, Quebec. W. W. Moorhouse (*Bull. Geol. Soc. Amer.*, 1941, 52, 601—632).—The complex ores occur in metamorphic rocks representing argillaceous and calcareous sediments, contact metamorphosed and injected by a granitic magma. The sulphide minerals comprise pyrite, sphalerite, pyrrhotite, galena, tetrahedrite, chalcopryite, and marcasite, deposited in the order named. Paragenesis is discussed. L. S. T.

Economic geology of California and Southern Oregon. C. V. Averill (*Bull. Geol. Soc. Amer.*, 1940, 51, 2017). L. S. T.

Genetic history of pegmatites and associated rocks of the Carolina tin belt. T. L. Kesler (*Bull. Geol. Soc. Amer.*, 1940, 51, 1999). L. S. T.

Heavy minerals and the history of the Coastal Plain. L. Dryden and C. Dryden (*Bull. Geol. Soc. Amer.*, 1940, 51, 1993—1994). L. S. T.

Granitisation in western New England. G. W. Bain (*Bull. Geol. Soc. Amer.*, 1940, 51, 1989). L. S. T.

Stratigraphy, structure, and petrology of the Mt. Cube area, New Hampshire. J. B. Hadley (*Bull. Geol. Soc. Amer.*, 1942, 53, 113—176).—Several chemical analyses are given. L. S. T.

Alkaline and carbonate intrusives near Bancroft, Ontario. F. Chayes (*Bull. Geol. Soc. Amer.*, 1942, 53, 449—511).—Chemical analyses are recorded. L. S. T.

Geology of S.E. Venezuela. V. M. López, E. Méncher, and J. H. Brineham, jun. (*Bull. Geol. Soc. Amer.*, 1942, 53, 849—872).—Chemical analyses are recorded. L. S. T.

Structure and metamorphism in the Mount Washington Area, New Hampshire. M. P. Billings (*Bull. Geol. Soc. Amer.*, 1941, 52, 863—935).—Chemical analyses are recorded. L. S. T.

Mineralisation in the West Tintic mining district, Utah. B. F. Stringham (*Bull. Geol. Soc. Amer.*, 1942, 53, 267—290). L. S. T.

Genesis of ore deposits of S.E. Maine. C. Y. Li (*Bull. Geol. Soc. Amer.*, 1942, 53, 15—51).—The genetic relation between the ore deposits (Cu, Zn, Pb, and some Ag) and the granite intrusive of S.E. Maine is discussed. Mines, prospects, and paragenesis are described. L. S. T.

Structure and metamorphism of Lewiston, Maine, Region. L. W. Fisher (*Bull. Geol. Soc. Amer.*, 1941, 52, 107—159).—Numerous chemical analyses [L. C. Armstrong; J. G. Thompson] are recorded. L. S. T.

Results of the Chilean mineralogical expedition of 1938. I. Identity of lapparentite with tamarugite. II. Crystallography of metavoltine. III. Penfieldite from Sierra Gorda, Chile. IV. Identity of salvadorite with kroehnkite. V. Cadwaladerite, a new aluminium mineral from Cerro Pintados, Chile. S. G. Gordon (*Not. Naturæ*, 1940, No. 57, 9 pp.; No. 64, 5 pp.; 1941, No. 69, 8 pp.; No. 72, 4 pp.; No. 80, 4 pp.; cf. A., 1943, I, 168).—I. Lapparentite is identical with tamarugite (I), the Chilean occurrences of which in Cerro Pintados, Alcaparrosa, and Quetena are described. (I) has ρ 2.07, α 1.484, β 1.486, γ 1.497 (all ± 0.001), and new chemical analyses (recorded) confirm the formula Na₂O, Al₂O₃, 4SO₃, 12H₂O.

II. Occurrences of metavoltine at Chuquicamata, Quetena, and La Compania are described; ρ is 2.51, and ω 1.595 and ϵ 1.581. The chemical analyses recorded agree with the formula K₂O, 3Na₂O, FeO, 3Fe₂O₃, 12SO₃, 18H₂O + 2H₂O.

III. Crystallography is described. Penfieldite, ρ 6.61, from Laurium, Greece, has the new formula Pb(OH)₂·3PbCl₂ (chemical analysis recorded).

IV. Crystallographic and optical data show that "salvadorite" is identical with kroehnkite (cf. Bandy, A., 1939, I, 163).

V. Cadwaladerite, Al(OH)₂Cl·4H₂O, amorphous, lemon-yellow, vitreous lustre, isotropic n 1.513, ρ 1.66 is described, and a chemical analysis [W. Pitman] given. L. S. T.

Origin of petroleum. E. N. Tiratsoo (*Petroleum*, 1943, 6, 7—9, 12).—Org. matter of marine origin may have undergone the necessary chemical change under the action of α -rays from radioactive igneous or sedimentary rocks. A. R. PE.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

DECEMBER, 1943.

I.—SUB-ATOMICS.

Continuum in the 1849 Å. region in the afterglow spectrum of mercury. A. Wattenberg and H. W. Webb (*Physical Rev.*, 1943, [ii], 64, 39—40).—A continuum reported by Garth (cf. A., 1941, I, 437) is confirmed, and a microphotometer record, with and without O₂ absorption bands, is given. N. M. B.

Determination of absolute intensities of spectral lines. G. S. Kvater (*J. Physics, U.S.S.R.*, 1942, 6, 210—217).—The discrepancy between the author's results (*J. Exp. Theor. Phys.*, 1941, 11, 402) for abs. intensity of Tl lines at 3776 and 5350 Å. by the anomalous dispersion method and those of Kuhn and Müller by absorption and magnetic rotation methods is discussed. Recalculation of Müller's results shows that the discrepancy resides in v.p. vals. for Tl. The absorption method affords an accurate measure of v.p. L. J. J.

New crystals to be used in chemical X-ray spectrography. G. Aminoff (*Arkiv Kemi, Min., Geol.*, 1943, 16, B, No. 10, 5 pp.).—Intensity and dispersion of the K α_1 radiation of Ag, Mo, Cu, Fe, Cr, and Sc, reflected from the scalenohedron 2131 of calcite and the 110 face of baryta (Dana's notation), have been determined, and the vals. compared with those of other crystals used in X-ray spectrography. W. R. A.

Origin of the M ζ_1 and M ζ_2 X-ray satellite groups. F. R. Hirsh, jun. (*Physical Rev.*, 1943, [ii], 64, 39; cf. Munier, A., 1940, I, 424).—The satellites are ascribed to initial MN ionisation involving the radiationless transition M $\text{III} \rightarrow M_V$. N. M. B.

Thermo-electromotive force. K. F. Herzfeld (*Physical Rev.*, 1943, [ii], 64, 37—38).—Mathematical. A simple kinetic interpretation, applicable in quantum and classical theory, is given. The usual expression can be transformed to agree with this result. N. M. B.

Spatial asymmetry of Cerenkov radiation as a function of electron energy. H. O. Wyckoff and J. E. Henderson (*Physical Rev.*, 1943, [ii], 64, 1—6).—A study, as a function of bombarding particle energy, of the Cerenkov radiation emitted when high-speed electrons traverse transparent media shows that the direction of emission of the radiation for mica over the range 240—815 kv. is given by the Frank-Tamm relation (cf. A., 1937, I, 220) $\cos \theta = 1/\beta n$, where θ is the angle of progression of the radiation with the electron beam and n is the refractive index of the mica target. In this range β [= (velocity of electrons in medium)/ c] changes markedly, providing a significant test of the relation as a function of bombarding particle energy. N. M. B.

Positive column of a helium discharge. N. A. Karelina (*J. Physics, U.S.S.R.*, 1942, 6, 218—223).—The dependence of potential gradient, electron temp. (T_e), and electron concn. on the radius and gas pressure (p) of the positive column in a He discharge has been investigated for $p = 10^{-2}$ —1 mm. and discharge current 300 ma. in a tube 32 mm. in diameter. The results agree with calculations for low-pressure plasma by Klarfeld's method (*ibid.*, 1941, 5, 155). At $p = 0.007$ mm. the val. of T_e is 188,000° K. L. J. J.

Chemical elements and natural atomic types according to the position of isotope and nuclear research (addendum to report on work from the end of 1939 to the end of 1940). O. Hahn (*Ber.*, 1941, 74, [A], 24, 27; cf. A., 1940, I, 185).—Few changes are noted since the previous report. From the relative abundance of Mo isotopes the at. wt. is given as 95.92 ± 0.01 (formerly 95.90). The deviation from the val. (95.95) in the International at. wt. table is therefore < before. J. W. A.

Electron mass in relation to energy of formation of the atoms: calculation of isotopic and atomic weights. H. D. K. Drew (*Chem. and Ind.*, 1943, 390—393).—It is suggested that there is a numerical connexion between the mass of the electron, m , and that of the proton, M_P , and the neutron, M_N , and the mass of ^{16}O . The isotopic wt. $I_W = AM_N - k$, where A = mass no. It is found that $aA + b = k$ (a = const., and b = a drifting const. common to two or more atoms in some of its vals. but in other cases applying to one atom only). $a = 18m$, so that if every term is expressed in electron masses, $18A + b = k$. Hence, when free particles coalesce to form atoms, a sum of energy = $18Am$ is withdrawn. It is divided into two

parts, k disappearing in so far as it is not represented as mass in the atom, and b appearing as mass. b is always negative. k/Z (Z = the no. of protons or planetary electrons in the atom) is integral and is the mass-contraction distribution index, Y , for a given atom. The integral relationship of Z and Y enables both k and b to be calc. if I_W is known with sufficient accuracy, since $k = ZY$ and $b = ZY - 18A$. When Y can be calc. from experimentally determined I_W , the true val. of I_W can be obtained from $I_W = AM_N - ZY$. Hence the at. wt. can be calc. if the Y nos. of all the isotopes are known. The vals. thus obtained agree well with experimental vals. The electron mass is thus an integral measure of the energy changes occurring in the formation of the atom. k/A is a convenient alternative to Aston's packing fraction, since it does not vary in sign, and compares the contraction of the atoms as a whole, and not with respect to ^{16}O . The interpretation of k and b is discussed. Both the nucleus and the planetary system of an element can be regarded as formed by the fusion of two lighter atoms, or of two atoms of a single lighter element. A. J. M.

Nuclear chemistry. R. Fleischmann (*Z. Elektrochem.*, 1941, 47, 8—16).—A review in which the types of nuclear reaction, and the particles which can bring them about, are discussed. Artificial radioactivity and nuclear isomerism are also dealt with. Laws governing nuclear reactions, and the applications of nuclear chemistry, are outlined. A. J. M.

Electrons in equilibrium with the penetrating component of cosmic rays in lead at 10,000 feet and at sea level. W. E. Hazen (*Physical Rev.*, 1943, [ii], 64, 7—10).—Measurements with Wilson cloud chambers containing Pb plates show that the no. of electrons (N) in equilibrium is $7.4 \pm 0.2\%$ at 10,000 ft. and $6.8 \pm 0.6\%$ at sea level. Comparison with calc. vals. of N shows that if the loss of low-energy electrons as a result of scattering in the Pb is taken into account, the calc. vals. are only slightly > the experimental vals. If the calc. vals. are assumed correct, the measurements provide additional evidence that protons constitute only a small fraction of the cosmic-ray particles in the lower atm. N. M. B.

Space distribution of particles in "Auger showers." D. V. Skobel'tzin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 14—19).—Auger's coincidence data (A., 1939, I, 400) are shown to be in agreement with calculations based on Euler's space distribution equation, $\rho r = \rho_0 e^{-r/R}$, relating the no. of particles (ρ) passing through unit cross-section with the distance (r) from centre of shower and the "half-radius" (R) of the shower. L. J. J.

Excited states of elementary particles. V. L. Ginzburg (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 9—13).—Two types of difficulty in relativistic quantum particle theory are discussed: (a) difficulties arising from the infinite proper energy of elementary particles; (b) difficulties arising from not taking into account the effect of the proper field of the particle on its scattering properties. If the proper field of the magnetic moment is taken into account, excited spin states of the particle must be postulated, and the wave equation must contain an empirical const. L. J. J.

Electron configuration as the basis of the periodic table. W. F. Luder (*J. Chem. Educ.*, 1943, 20, 21—26).—Charts based on electron configuration of the elements are reproduced and discussed. The at. structure chart recommended should replace arrangements of the elements based on Mendeléeff's classification. L. S. T.

Approximate equations of transfer of radiation in a scattering and absorbing medium. E. S. Kuznetsov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 209—214).—Mathematical. W. R. A.

II.—MOLECULAR STRUCTURE.

Intensity theories in band spectra. I. Hutchisson's theory. II. Langstroth's theory. N. R. Tawde and V. S. Patankar (*Proc. Physical Soc.*, 1943, 55, 396—403, 403—409).—I Integrated intensity vals. (I) for all measurable bands of the second positive system of N₂, excited by an induction coil (without spark-gap or condenser), were determined by photographic photometry. Transition probabilities for bands in emission are calc. from known mol. consts. with the help of Hutchisson's formula. Observed I/ν^4 vals. for

bands of different v'' -progressions do not agree satisfactorily with calc. emission probabilities, but agreement is improved by interchanging the vibrational quantum numbers. Explanations are discussed.

II. Vals. of I were determined, as above, for 24 bands, compared with only 3 estimated by Langstroth. From calc. $P^{2v'v''}$ vals. and excitation probabilities $P^{2v'v''}$ the "complete intensities" $P^{2v'v'} \times P^{2v'v''}$ are calc., as suggested by Langstroth. Observed I/v^4 vals. for different bands of the system do not show satisfactory agreement with calc. "complete intensities," but agreement is improved if, in the calculation of the complete intensity for the (x, y) band, the emission probability $P^{2v'v''}$ calc. for the (x, y) band is used. Reasons for discrepancies are given and discussed.

N. M. B.

Intensity anomalies and perturbations in the CN bands. A. T. Wager (*Physical Rev.*, 1943, [ii], 64, 18—31).—The rotational structures of the (0, 0) violet and (9, 4) red CN bands, developed by CHCl_3 in active N, were measured on plates in the first and second orders of a 30-ft. grating. Data for rotational consts., Λ -doubling, spin doubling, perturbations, and shifts are given. The vals. of the perturbation matrix elements are obtained for the various levels. Anomalies of R branch lines in the (0, 0) band are noted. The mechanism of enhancements of the main and extra lines of this band is discussed. Collisions involving interstate transfer ($^2\Pi \rightarrow \alpha^2\Sigma$) occur, or are enhanced, at each perturbed level; rapid redistribution of mols. among rotational levels by collisions must also occur. Where spin doublets are resolvable in the violet band, rotational redistribution occurs without change of spin direction.

N. M. B.

Continuous emission bands in the spectrum of carbon tetrachloride. R. K. Asundi, N. L. Singh, and J. P. Mishra (*Current Sci.*, 1943, 12, 204—205).—Bands in the range 4620—2450 Å., except those at 4620 and 3340 Å., are identical with those obtained in a discharge through Cl_2 , and are probably due to Cl_2 or Cl_2^+ . The strong 4620 Å. band is attributed to a transition in the CCl_4 mol. from the ground level of CCl to the repulsive curve of CCl_2 , and the weak band at 3340 Å. to the transition from the same initial level to the repulsive curve of CCl_3 , in complete analogy to the continuous spectra in SnCl_4 .

N. M. B.

Configuration of $\Delta^{\alpha\gamma}$ -butadiene. R. S. Rasmussen, D. D. Tunnichiff, and R. R. Brattain (*J. Chem. Physics*, 1943, 11, 432—433).—Ultra-violet absorption by $(\text{CH}_2\text{CH})_2$ vapour at 2200—2400 Å. increases markedly with temp. in the range 10—40°, probably owing to rapidly-changing *cis-trans* equilibrium. Of 10 infra-red bands at 520—1500 cm^{-1} measured, 6 frequencies coincide with Bradacs and Kahovec's Raman frequencies (A., 1943, I, 31) measured at low temp., indicating predominance of the *cis*-form at low temp. Hence the *cis*- is the form of lower energy.

L. J. J.

Ultra-violet absorption spectrum of formic acid. B. Sugarman (*Proc. Physical Soc.*, 1943, 55, 429—430).—Data are reported for bands photographed in the range 2260—2600 Å., and an expression for $1/\lambda$ is found.

N. M. B.

Absorption spectra of substituted nitrosobenzenes. Resonance effect of substituents. Y. Tsuzuki, T. Uemura, and N. Hirasawa (*Ber.*, 1941, 74, [B], 616—621; cf. A., 1942, I, 39).—Absorption measurements are recorded for *o*-, *m*-, and *p*- $\text{C}_6\text{H}_4\text{MeNO}$ and for *p*- $\text{C}_6\text{H}_4\text{XNO}$ ($\text{X} = \text{Cl}, \text{Br}, \text{I}$). In every case the absorption max. of PhNO is displaced towards greater λ , the effect being in the order *p*- > *o*- > *m*-Me, $\text{I} > \text{Br} > \text{Cl}$. Considered in conjunction with published data the results indicate that parallelism exists between the *op*-directing activity of substituents and their effect on light absorption.

F. L. U.

Mesomeric anions containing nitro-groups. G. Kortüm (*Ber.*, 1941, 74, [B], 409—416).—The displacement in the absorption max. towards the red of *o*-, *m*-, and *p*- $\text{NO}_2\text{C}_6\text{H}_4\text{O}^-$ (in H_2O or dioxan) indicates that each ion exists in a limiting quinonoid form (which is not dependent on hydration). For *s*- $\text{C}_6\text{H}_5(\text{NO}_2)_3$ (I), the "quinonoid" anion is undoubtedly hydrated. Thus (I) and NH_3 in dioxan show no colour change until H_2O is added.

H. B.

Absorption of light by organic molecules and ions according to quantum mechanics. T. Förster (*Z. Elektrochem.*, 1941, 47, 52—54).—The application of quantum mechanics to light absorption by org. mols. is considered, with special reference to the polyenes and $(\text{CPh}_3)^+$, and its mono-, di-, and tri-substitution derivatives. A theoretical substitution rule is deduced stating that the absorption range of an unsubstituted ion breaks into two regions, one of shorter and the other of longer λ , when the first auxochromic group is substituted. When the second auxochromic group is substituted both regions are shifted to longer λ , and when the third is substituted, the two regions merge into one of intermediate λ . This is verified by experiment.

A. J. M.

Ultra-violet absorption of some resins of the formaldehyde-phenol type. E. Mayer-Pitsch and H. Troger (*Z. Elektrochem.*, 1941, 47, 60—65).—The dialcohol, 4-cyclohexyl-2:6-di(hydroxymethyl)-phenol (I), loses H_2O on heating, CH_2O bridges linking the

mols. Further heating may result in loss of CH_2O , and formation of a CH_2O bridge to the 1-position. (I) may also give 2:6-diformyl-4-cyclohexylphenol (II). The formation of these compounds was followed by determination of ultra-violet absorption spectra. When the resin from (I) was strongly heated, (II) was found in the sublimate. When the resin itself was dissolved in cyclohexane, ultra-violet absorption indicated the presence of (II).

A. J. M.

Physico-chemical properties of chromophoric groups. Complete analysis of absorption spectra. III. E. Hertel (*Z. Elektrochem.*, 1941, 47, 28—34).—The question whether chromophoric properties are associated with single atoms of a group, or with the whole group, is discussed. In some cases the effect of a group cannot be analysed to that of the component atoms. The connexion between the position of the long- λ absorption range and the polarity of the chromophoric group is considered. No simple relationship connects polarity and absorption. In the case of cinnamylidene derivatives, the absorption is largely independent of substituents, although these alter considerably the distribution of charges within the mol., but this is not always the case. The transition of an atom into the ionic state alters the properties of chromophoric groups only in degree (*i.e.*, it causes displacement or intensification). Phenolic O, N in NHPh_2 derivatives, and C in CHPh_3 derivatives are not chromophoric.

A. J. M.

Assignment of absorption bands in conjugated systems of chromophores. G. Kortüm (*Z. Elektrochem.*, 1941, 47, 55—59).—Two classes of absorption bands may be distinguished, those due to individual double bonds ("localised"), which are comparatively weak, and the more intense, fundamental bands, due to conjugation of localised double bonds, which cannot be ascribed to any particular double bond. Although conjugation may exist, the absorption due to individual chromophores may often still be recognised. This is due to the fact that certain electromeric limiting structures participate largely or exclusively in the stationary states of the mol. Localised bands disappear when such participation does not occur. The systematic change in the absorption of the anion of nitronic acids by the introduction of various groups is explained on this view.

A. J. M.

Conjugation of chromophores and constitution of organic compounds. M. Pestemer (*Z. Elektrochem.*, 1941, 47, 20—28).—The possibility of using ultra-violet absorption spectra to determine the constitution of org. mols. is discussed. Groups of conjugated chromophores can readily be recognised in a mol. when limited by CH_2 groups. The position of chromophores with respect to each other, and of substituents, gives rise to characteristic differences in the ultra-violet absorption spectrum. Examples drawn from *cis-trans* isomerism, tautomerism, chain-conjugation of chromophores, the nature of condensed rings in hydrogenated and dehydrogenated isocyclic hydrocarbons, and the detection of definite NH_2 -acids in proteins are given.

A. J. M.

Effect of acidifying substituents on chromophoric systems. B. Eistert (*Z. Elektrochem.*, 1941, 47, 35—40).—The effect of groups such as NO_2 , SO_2R , COR , and CN , when substituted in CH_4 and more complex compounds, on chromophoric groups is reviewed, the acidic properties of the resultant mol. and the possibility of mesomerism being particularly considered. There is no simple relationship between the position of the absorption bands of the anion and the acid-producing effect of the substituent. The SO_2R group affects absorption by its inductive effect, whilst the other groups exert also a secondary electromeric effect on the stability and structure of the anion. Thus, $\text{CHPh}(\text{C}_6\text{H}_4\text{NO}_2\text{-}p)_2$ (I) (colourless) gives intensely violet-coloured salts with NaOH , but colourless $\text{CHPh}(\text{C}_6\text{H}_4\text{SO}_2\text{Me-}p)_2$ remains colourless in NaOH . In the latter, the inductive effect of the SO_2Me on the methane-C is small, as such effects are short-ranged. Mesomerism is thus very small, whereas in (I) mesomerism can occur, and (I) is coloured. The introduction of acidifying groups into cation-halochromic systems is also considered. Here the effect is essentially inductive, and COR and SO_2R produce similar effects.

A. J. M.

Acidity constants, resonance energies, and light absorption of simple dyes. G. Schwarzenbach (*Z. Elektrochem.*, 1941, 47, 40—52).—It is possible to study the colour changes of substances with pH from -10 to +17 by using solvents other than H_2O . In passing through this range of pH, there is usually a periodic change of colour. In the case of dyes with two auxochromic groups, a bathochromic change of colour always follows a hypsochromic one, and vice versa. The larger is the no. of auxochromic groups, the more complicated is the periodicity. A new theory of colour in org. compounds covers these and other properties of dyes. The position of the long- λ absorption band is decided by the symmetry of the coloured particle, which affects the resonance energies of the various limiting structures. It is also affected by the length of the resonance chain between the auxochromic groups, and by sp. effects due to the constitution and nature of these groups. The resonance energies of the majority of coloured particles can be estimated from acidity consts.

A. J. M.

Light absorption and energy propagation by loose complexes in organic dyes. G. Scheibe (*Z. Elektrochem.*, 1941, 47, 73—80).—Previous work on ψ -isocyanine diethochloride (I) in aq. solution is reviewed (cf. A., 1937, I, 165, 494; 1938, I, 117, 434; 1939, I, 452). As concn. is increased, a new absorption band appears at a definite concn. It is very narrow, and of longer λ than the bands normally given by (I), and is accompanied by resonance fluorescence. When diluted or warmed the solution loses this absorption. Similar phenomena are shown by mixtures of these dyes with others. The new narrow band appearing in this case is not characteristic of either component but is intermediate in λ , and must indicate the formation of a new absorption complex. Several series of compounds related to (I) have been prepared, and their absorptions determined. Replacement of Me by Et on the N of simple ψ -isocyanines produces very little shift of the principal absorption band, but with the 3-Me derivative of (I), replacement of NMe by NEt in the substituted quinoline ring causes considerable displacement towards the red. A similar replacement in the unsubstituted quinoline ring, however, has very little effect. This is due to steric hindrance. These and effects of a similar kind observed with related dyes are considered in connexion with the polarisation of light reflected from and absorbed by the mols. A. J. M.

Polarisation of adsorbed substances. IV. Colour change and catalytic effect as a consequence of polarisation due to absorption of surface-active substances. E. Weitz [with F. Schmidt and J. Singer] (*Z. Elektrochem.*, 1941, 47, 65—73).—Largely a summary, with experimental data, of work previously described (cf. A., 1940, I, 109, 158, 319), showing that polarisation of a colourless mol. at the surface of a solid adsorbent may cause it to become coloured. When the adsorbate is eluted, the colour disappears. Certain coloured compounds, which are feebly ionised, become colourless when adsorbed. Many examples are given. A. J. M.

Fluorescence and phosphorescence of crystal phosphors. A. Schleede (*Angew. Chem.*, 1940, 53, 378—383).—A review dealing with the structure of crystal phosphors and the mechanism of phosphorescence, with special reference to ZnS phosphors. A. J. M.

Chemical and physical properties of luminescent materials. J. W. Strange (*Proc. Physical Soc.*, 1943, 55, 364—371).—A lecture survey of development, application, and theory. N. M. B.

Light emission of solid insulators. F. Mögliche (*Angew. Chem.*, 1940, 53, 405—409).—A theoretical explanation, based on the quantum theory, of the emission of light from hot insulating material, e.g., quartz or thoria, is offered. A. R. P.

Infra-red and Raman spectra of polyatomic molecules. XVIII. Trideuteronitromethane. XX. cyclobutane. T. P. Wilson (*J. Chem. Physics*, 1943, 11, 361—368, 369—378).—XVIII. The infra-red (3—25 μ .) and Raman spectra of $\text{CD}_3\cdot\text{NO}_2$ have been investigated; combined with the data of Wells and Wilson (A., 1941, I, 241) on MeNO_2 , they lead to the assignment of all the fundamental ν , except the C—N bond torsion. A potential function has been derived by a normal co-ordinate treatment.

XX. Raman and infra-red (2—25 μ .) spectra of cyclobutane have been determined, and a tentative assignment of fundamental ν has been made. Δ^2 -Butene has been recognised as a product of liquid-phase photolysis of cyclopentanone. W. R. A.

Detection of carbonyl groups in aldols by means of Raman spectra.—See A., 1943, II, 319.

Structure of the Rayleigh line and the viscosity of liquids. E. Gross and A. Siromiatnikov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 219—221).—Measurements of the spectra of scattering of p -cresol (I) and of PhOH at room temp. and at 140° for (I) and 74° for PhOH confirm the view, derived from theoretical considerations, that in viscous liquids the intensity of the depolarised undisplaced component of the Rayleigh line is connected with the depolarised background observed near the components of the triplet. On heating (I) or PhOH η decreases markedly; the undisplaced line decreases in intensity, and a strong depolarised continuous background appears in its neighbourhood. L. S. T.

Photo-conductivity of lead chromate. J. E. Goldman and A. W. Lawson (*Physical Rev.*, 1943, [ii], 64, 11—18).—The conductivity referred to unit intensity of the incident radiation is a max. in the blue, corresponding with a val. of 5×10^{-3} amp. per w. at saturation. There are subsidiary max. in the red and near ultra-violet. Results conflict with those of previous investigations. Data on the spectral scattering of PbCrO_4 are presented. The dependence of photo-conductivity on time, electric field, and previous history of the specimen is illustrated. On the basis of unit quantum efficiency, the mean displacement distance of photo-electrons in PbCrO_4 is 3×10^{-3} cm. Various explanations of the observed behaviour are discussed. N. M. B.

Electrical properties of polyvinyl acetate. T. W. Dakin (*Trans. Electrochem. Soc.*, 1943, 83, Preprint 27, 309—317).— ϵ and loss factors were determined for five samples of polyvinyl acetate of

different mol. wt. and at different frequencies. In general, the loss factor-frequency curves were displaced uniformly to higher frequencies with decreasing mol. wt., apart from one exception. The material probably has at least three regions of ϵ dispersion in the frequency spectrum: the largest occurs at low frequencies and will occur in the audio-frequency range when the polymer starts to soften; the second is at room temp. at a few megacycles frequency; and the third, which has not been detected, is anticipated at an extremely high frequency at 25°. The observations are discussed in relation to mol. structure and thermodynamic considerations. C. E. H.

Effect of pressure on the dielectric constants of liquids. B. B. Owen and S. R. Brinkley, jun. (*Physical Rev.*, 1943, [ii], 64, 32—36).—An empirical equation containing two parameters A and B expresses the isothermal variation of ϵ of liquids with pressure. Comparisons with experimental data are tabulated for 21 liquids. The equation is analogous to the Tait equation for the variation of liquid d with pressure; B is common to both and can be obtained from ϵ or d . Elimination of B between the two equations gives a linear relationship between the reciprocals of ϵ and d , and this relationship can be derived from Tammann's hypothesis and electrostatic theory. N. M. B.

Theory of insulators. P. Böning (*Kolloid-Z.*, 1940, 92, 136—141).—A theory of insulators, based on the assumption that all insulators are solid dispersions, is proposed. In liquid dispersions, the particles are charged, and are surrounded with ions of opposite charge. If H_2O is removed from such a disperse system, the colloidal particles retain their charges, and the ions remain in the pores of the material as adsorbed ions. Over these is a layer of less firmly held ions, with an equal and opposite charge. The fact that such a system of charges exists, e.g., in clay particles, is shown by electro-endosmosis. All substances which can be used as diaphragms in electro-endosmosis are colloidal, and usually contain, in addition to the adsorbed ions and the ions of opposite charge, a certain no. of ordinary dissociated ions. If such a substance is subjected to an electric field, a current flows through the pores and channels, being carried by the dissociated ions. When the field strength reaches a certain min. val. the upper ions move; the adsorbed ions are thus freed and, at a certain field strength, begin to move. This theory accounts for the potential distribution and space charge in dielectrics, dielectric breakdown, back potential and anomalous currents, capacity changes, and dielectric loss, better than the absorption or dipole theories. A. J. M.

Dielectric behaviour of nitrogenous heterocyclic compounds in aqueous solution. W. Hückel and W. Jahnentz (*Ber.*, 1941, 74, [B], 652—656).—Dielectric const. (ϵ) of aq. solutions of glyoxaline (I), 4-methylglyoxaline (II), pyridazone (III), pyrazole, and 1:2:4-triazole have been measured, also their dipole moments (μ) in C_6H_6 and/or dioxan solution. The dielectric increment ($d\epsilon/dc$) is zero for (I) and negative for all the other substances examined. Considerations advanced by Devoto (A., 1932, 794) are applied to the calculation of μ , and the calc. vals. agree with those observed only for the compounds (I), (II), and (III), which are believed on independent evidence to form zwitterions; the failure of these substances to increase the ϵ of H_2O is attributed to the proximity of their ionising groups. Data are recorded for the mol. refraction and μ of (III). F. L. U.

Magneto-optical rotation of hydrogen peroxide. P. A. Giguère and H. Feeny (*Canad. J. Res.*, 1943, 21, A, 69—73).—The Verdet const. for H_2O_2 at 10°, obtained by extrapolation of data for the magnetic rotatory power of aq. solutions of H_2O_2 , are 0.01148, 0.01190, 0.01352, and 0.02265 min. per gauss-cm. at $\lambda\lambda$ 5893, 5780, 5461, and 4359 Å., respectively. C. R. H.

Kerr electro-optical effect in solutions of p -azoxyanisole. N. Tolstoi and V. Tzvetkov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 230—232).—Average vals. of the Kerr const. are $(0.83 \pm 0.05) \times 10^{-32}$ for p -azoxyanisole (I) in C_6H_6 , and $(0.31 \pm 0.11) \times 10^{-32}$ in CCl_4 . The corresponding angles (calc.) between the dipole and the axis of the mol. are 47° and 55°, showing that (I) contains p - $\text{OMe}\cdot\text{C}_6\text{H}_4\cdot\text{NO}\cdot\text{N}\cdot\text{C}_6\text{H}_4\cdot\text{OMe}$ - p . L. S. T.

Internal rotation in gaseous molecules. I. A. Maccoll (*J. Proc. Austral. Chem. Inst.*, 1943, 10, 91—99).—Free rotation about the C—C linking in mols. of the C_2H_6 type is discussed, reference being made to appropriate potential functions. Dipole moment and electron diffraction measurements on $(\text{CH}_2\text{Cl})_2$ support the view that rotation about the C—C linking is restricted, being of a vibrational type at lower temp. and becoming free only at high temp. J. W. S.

Internal rotation in gaseous molecules. II. A. Maccoll (*J. Proc. Austral. Chem. Inst.*, 1943, 10, 161—168; cf. preceding abstract).—Comparison of observed and calc. thermodynamic quantities and of Raman and infra-red spectra indicates restricted rotation around the C—C single linking. Theoretical attempts to account for the restricting potentials are examined, and the isolation of rotational isomerides is discussed. N. M. B.

Chemical linking. H. G. Grimm (*Angew. Chem.*, 1940, 53, 288—292).—A review of the nature of the four types of chemical linking, and of methods of detecting them. The connexion between the type of linking and the structure of the atoms concerned is discussed. There is a periodicity in regard to the nature of the linking corresponding to position in the periodic table. A. J. M.

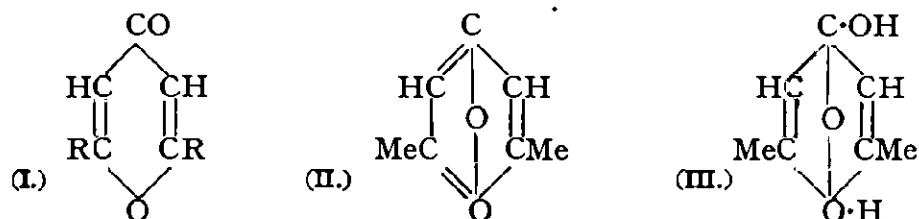
Structure of boron hydrides. II. M. E. Diatkina and J. K. Sirkin (*J. Phys. Chem. Russ.*, 1943, 17, 20—23).—It is suggested that in B_2H_4 two BH_2 groups are in one plane and the remaining two H are on a perpendicular axis. The electron diffraction results (cf. Bauer, A., 1937, I, 397) agree with this structure. J. J. B.

Statistical length of paraffin molecules. L. R. G. Treloar (*Proc. Physical Soc.*, 1943, 55, 345—361).—Methods are outlined for representing the distribution of lengths of a thermally fluctuating paraffin mol. over the whole range of any chain length. Results for paraffin chains of 3, 4, 5, 10, 20, 40, and 80 links are given. For the higher members of the series results diverge rapidly from the Kuhn formula as the length approaches that of the extended chain; this is important in the development of the kinetic theory of elasticity of rubber. N. M. B.

Measurement of the temperature coefficient of the surface tension of mercury. A. M. Didenko and N. L. Pokrovski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, 31, 233—236).—Apparatus for measuring γ of Hg by Kantor's method is described. Measurements of γ at 0—300° are recorded graphically. $\gamma = 459.10 - 0.20\theta$ dynes per cm. L. S. T.

Parachors of thymol, menthol, and *p*-toluidine in different solutions. S. S. Deshapande, S. N. Kaweeshwa, and W. V. Bhagwat (*J. Indian Chem. Soc.*, 1942, 19, 149—152).—The parachors of thymol in $PhNO_2$ and in $AcOH$, of menthol in $PhNO_2$ and in CCl_4 , and of *p*-toluidine in $PhNO_2$ have been determined at different concns. and temp. Vals. calc. from Hammick and Andrew's equation deviate from the theoretical at low concns., but are not appreciably affected by temp. (whether $>$ or $<$ the m.p.) or by the nature of the solvent. A. Li.

Parachor of some organic compounds and their chemical constitution. S. S. Deshapande, S. N. Kaweeshwar, and W. V. Bhagwat (*J. Indian Chem. Soc.*, 1942, 19, 153—158).—Parachor determinations in $EtOAc$ and $PhNO_2$ show that pyrone and diethylpyrone have the simple ring structure (I), but favour structure (II)



for dimethylpyrone and (III) for diacetylacetone. Dehydracetic acid has the simple ring structure. Diacetylacetone probably has the bridged ring structure. The method of calculation for the bridged ring system is confirmed by determinations on oximinocamphor. A. Li.

III.—CRYSTAL STRUCTURE.

New aspects of X-ray analysis. I. Index of X-ray diffraction data. II. Non-Laue diffuse reflexions in X-ray diffraction patterns. III. Examination of fine structural characteristics by X-ray powder methods. IV. Absolute accuracy of X-ray wave-lengths. H. P. Rooksby (*Elect. Times*, 1943, 104, 212—214, 242—244, 270—274, 300—302). C. P. P.

Graphical evaluation of Debye-Scherrer photographs. F. Fehér (*Z. Elektrochem.*, 1941, 47, 369—374).—A graphical method which permits the rapid determination of the lattice consts. from the observed positions of interference rings on Debye-Scherrer records, together with a knowledge of the mol. wt. and d of the material investigated, is described and illustrated. J. W. S.

MX_2 layer lattices with close-packed X atoms. G. Hägg (*Arkiv Kemi, Min., Geol.*, 1943, 16, B, No. 3, 6 pp.).—Notations by which layer lattices of different types may be represented are described. Possible types of ordered and random layer lattices for compounds of the MX_2 type are discussed, with reference to lattice factors governing the order-disorder transformation. A. J. E. W.

Crystal structures of cadmium bromide and cadmium iodide. G. Hägg, R. Kiessling, and E. Lindén (*Arkiv Kemi, Min., Geol.*, 1943, 16, B, No. 4, 9 pp.).— $CdBr_2$ cryst. from a melt, or obtained by dehydration of $CdBr_2 \cdot 4H_2O$ at 200°, has the C19 structure. Dehydration at room temp., grinding of the C19 structure, or crystallisation from $EtOH$, $MeOH$, or $COMe_2$ leads to a random layer lattice. Transformation of this lattice into the C19 structure occurs only at temp. (e.g., 300°) at which recrystallisation occurs. CdI_2 cryst. from a melt or slowly from H_2O has a C27 structure. Crystallisation from liquid SO_2 , condensation from the vapour, or grinding produces

a random layer lattice. $MeOH$ solutions deposit a random layer lattice tending towards the C6 structure; specimens from H_2O (cryst. rapidly), $EtOH$, or $COMe_2$ are similar, but often contain some of the C27 form. The form deposited depends on the rate of crystallisation (k), the random layer lattice and the C6 and C27 structures, respectively, being obtained as k decreases; the three forms have identical sp. vol. Transformation of the random lattice into the other structures occurs only at $>300^\circ$, at which temp. recrystallisation is also observed. A. J. E. W.

X-Ray studies on the system cadmium bromide-cadmium iodide. G. Hägg and E. Emdén (*Arkiv Kemi, Min., Geol.*, 1943, 16, B, No. 5, 10 pp.).—The $CdBr_2$ phase (C19 structure) can dissolve ≤ 43 mol.-% CdI_2 , and the CdI_2 phase (C27) ≤ 44 mol.-% $CdBr_2$; $CdBrI$ occurs as an intermediate phase. All cryst. phases give a random layer structure when ground. $CdBrI$ forms a layer lattice in which the halogen atoms are close-packed, 12 layers being arranged in the order ABCBCABABCAC (*cchh*); Cd atoms are inserted between every second halogen layer. $CdBrI$ has a rhombohedral translation group, with a unit cell (2 mols.) having r 13.46 Å., α 17° 56'; Laue symmetry, D_{3d}^{3d} ; space-group C_{3v}^{3d} — $R\bar{3}m$ (Br and I in separate layers) or D_{3d}^{3d} — $R\bar{3}m$ (Br and I distributed at random). At. parameters for both possible space-groups are given. A. J. E. W.

Structure of liquid carbon tetrachloride. E. E. Bray and N. S. Gingrich (*J. Chem. Physics*, 1943, 11, 351—354).—Radial electron density distribution curves have been calc. from the X-ray diffraction patterns of liquid CCl_4 at 25° and -20° . Discrete peaks correspond with interat. distances of 1.7 and 2.9 Å. at -20° , and 1.74 and 2.92 Å. at 25°. Non-discrete peaks (3.6, 4.1, 6.4 Å. at -20° ; 4.0, 6.3 Å. at 25°) due to atoms in different mols. have been obtained. W. R. A.

Morphology of finest sublimed lead oxide [minium]. I. R. Meldau and M. Teichmüller (*Z. Elektrochem.*, 1941, 47, 95—97).— Pb_3O_4 , prepared by vaporising Pb in an electric arc in the presence of definite quantities of O_2 , was rapidly cooled, and the sublimate examined by the electron microscope. The particles are mostly rounded, but some appear with an octagonal outline, which represents a prism with terminal pyramids. X-Ray analysis showed definite interference rings. It is concluded that the crystals belong to the tetragonal system. A. J. M.

X-Ray study of chrysotile asbestos.—See A., 1943, I, 268.

X-Ray diffraction investigation of sodium stearate from room temperature to the m.p. A. de Bretteville, jun., and J. W. McBain (*J. Chem. Physics*, 1943, 11, 426—429).—Diffraction of $Cu K_\alpha$ radiation by the γ -form of Na stearate at seven temp. (25—301°) shows const. long spacing (44.3—44.7 Å.) up to 132°, the subwaxy-waxy transition point, followed by a decrease with increasing temp. to 31.9 Å. at 301°. The two most intense short spacings increase in length from 4.68 and 4.05 Å. at 25° up to the waxy-cryst.-superwaxy transition point at 167°, and then coalesce to a single spacing up to the liquid-cryst.-liquid m.p. at 288°. A monoclinic space-lattice, with hexagonal close packing of the chains above 167°, is assumed. L. J. J.

Fine structure of the cellulose fibre. K. H. Meyer and A. J. A. van der Wyk (*Z. Elektrochem.*, 1941, 47, 353—360).—A review of experimental investigations indicates that the principal valency chains in dry cellulose fibre lie closely packed and parallel to the axis of the fibre, the planes of the glucose rings being oriented in a definite manner with respect to the cell wall. The presence of cavities interrupting the packing accounts for the fibrillar structure. J. W. S.

Structure of molecular compounds. II. H. M. Powell and G. Huse (*J.C.S.*, 1943, 435—437; cf. A., 1943, I, 177).—M.p. and intensities of reflexion of X-rays, including diffuse spectra, of crystals of the mol. compounds of C_6Me_6 with picryl halides have been determined, and used to show that the crystals consist of weakly-bound alternate layers of the two components. The existence of ions in crystals of mol. compounds is unlikely. W. R. A.

IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

Physical data of *p*-alkyltoluenes. A. W. Schmidt and V. Schoeller (*Ber.*, 1941, 74, [B], 258—264).— $p-C_6H_4Me \cdot C_nH_{2n+1}$, where $n = 1-8, 10, 12$, and 14, were prepared by reducing ($N_2H_4 + NaOEt$) the ketones obtained from $PhMe$ and the appropriate acyl chlorides in the Friedel-Crafts reaction. Mol. wt., b.p., m.p., d_4^{20} , and n_D^{20} data are recorded, and η -temp. curves given. J. Wa.

Dimensions of physical magnitudes. III. Electric and magnetic magnitudes. H. Dingle (*Phil. Mag.*, 1943, [vii], 34, 588—599).—An extension and amplification of previous work (*ibid.*, 1942, 33, 321). The definition of the magnitude of an electrical or magnetic quantity (e.g., e.m.f.) consists of a statement of a process of measurement involving ultimately only mechanical quantities. The quantity thus defined is therefore expressible dimensionally in terms

of $[M]$, $[L]$, and $[T]$; the dimensional equation is regarded as an indication not of the physical nature of the quantity, but of the defining process adopted. Experimental relations between the various quantities necessitate the introduction of two "dimensional consts.," which replace, but are not identical with, μ and κ of the usual scheme.

H. J. W.

Electrical conduction of textiles.—See A., 1943, I, 258.

Variation of superconductivity of tin under non-uniform tension. B. G. Lazarev and A. A. Galkin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **37**, 91—92).—Sn wires (diameter ~ 0.06 mm.) cooled under tension (in liquid He?) show increases in crit. superconductivity temp. from 3.715° to $\sim 9^\circ$, in H_c^2 from ~ 210 to $\sim 2.5 \times 10^4$ gauss, in dH_c/dT from ~ 130 to ~ 2000 , and in $R_{4.2^\circ}/R_{290^\circ}$ from 1.5×10^{-3} to ~ 0.3 , and a decrease in I_c^2 from ~ 3 to 0.067 . It is concluded that local strains as large as 10^5 kg. per sq. cm. exist, and that irregular deformation of the crystal lattice has occurred.

M. H. M. A.

Magnetic susceptibilities of metals dissolved in liquid ammonia. S. Freed and N. Sugarman (*J. Chem. Physics*, 1943, **11**, 354—360).—Magnetic susceptibilities of liquid NH_3 solutions of K, Cs, Ba, and Ca have been measured at 200° and 240° K., by a low-temp. modification of the Gouy method. The magnetic behaviour resembles that of a free-electron gas, overlaid by effects characteristic of the solution. A structure is proposed for the solutions, with reference to the electrons which conduct electricity.

W. R. A.

Scientific significance of ferromagnetism. F. Bitter (*J. Washington Acad. Sci.*, 1943, **33**, 235—238).—A lecture.

L. S. T.

Magnetic and other properties of crystalline horse-liver catalase and derivatives.—See A., 1943, III, 841.

Supersonic measurements in carbon dioxide and water vapour at 98° . W. H. Pielemeier and W. H. Byers (*J. Acoust. Soc. Amer.*, 1943, **15**, 17—21).—Previously reported results (cf. A., 1940, I, 104) suggest that there are two overlapping absorption regions for supersonic waves in CO_2 - H_2O vapour mixtures at 28° . The present measurements of absorption in CO_2 - H_2O and sound velocity in dry CO_2 , all at 98° , were made in the expectation, which was not fulfilled, that the resolution of the absorption max. would be improved. The results lead to a satisfactory calc. val. for the sp. heat of CO_2 .

H. J. W.

Supersonic measurements in carbon dioxide at 0° to 100° . W. H. Pielemeier (*J. Acoust. Soc. Amer.*, 1943, **15**, 22—26).—Experimental data due to a no. of observers are discussed. Most probable velocity-temp. curves for dry CO_2 are plotted for long and short λ . The effect of adding H_2O vapour is examined. Evidence for the existence of two relaxation times (cf. preceding abstract) is reviewed.

H. J. W.

Specific heats of carbon tetrafluoride from supersonic measurements. W. H. Byers (*J. Chem. Physics*, 1943, **11**, 348—350).—Velocity and absorption of supersonic waves of 290.7 and 615.6 kilocycles in CF_4 have been measured at 0.3 — 3 atm. The sp. heat for equilibrium conditions (13.5 ± 0.5 g.-cal. per g.-mol. at const. vol.), the sp. heat due to intramol. vibrations (7.5 ± 0.7 g.-cal. per g.-mol.), and the mean life of a quantum of vibrational energy [$(7.6 \pm 0.5) \times 10^{-7}$ sec.] have been calc. from the dispersion and absorption curves.

W. R. A.

Vapour pressure of the sulphides of antimony, lead, cadmium, and zinc. B. K. Veselovski (*J. Appl. Chem. Russ.*, 1942, **15**, 422—436).—Knudsen's effusion method was used and checked on KCl between 886° and 971° K. Log p (in mm. Hg) of stable Sb_2S_3 at 665 — 809° K. is $12.546 - 11200/T$, of CdS at 828 — 1030° K., $9.823 - 11256/T$, and of ZnS (sphalerite) at 1038 — 1496° K., $9.495 - 14200/T$. Log p of PbS is 3.242 at 879° and 1.586 at 1069° K. The error is $\pm 5\%$ except for ZnS , for which it is larger because of oxidation. Thermodynamic functions of the sulphides are calc.; it is necessary to assume that Sb_4S_6 is the correct formula of Sb sulphide. Freshly sublimed Sb_4S_6 has a higher v.p. than recryst. Sb_4S_6 .

J. J. B.

Thermal conductivity of non-metallic single crystals. W. J. Knapp (*J. Amer. Ceram. Soc.*, 1943, **26**, 48—55).—Measurements of the thermal conductivity (C) of single crystals (1 cm.³) of quartz, corundum, sapphire, beryl, tourmaline, synthetic LiF, topaz, zircon, and periclase and samples of electrocast mullite and a Na_2O - CaO glass, Pyrex, and pure fused SiO_2 were made at 100 — 500° . The C of crystals along the various crystallographic axes differed markedly, but the difference decreased at higher temp. Single crystals give a min. C with rising temp., which agrees with Compton's theory. C of glasses increases approx. linearly with temp.

J. A. S.

Viscosity at the b.p.: the rheochor. J. N. Friend and W. D. Hargreaves (*Phil. Mag.*, 1943, [vii], **34**, 643—650).—The rheochor is defined as $R = (\eta^{1/8} \times \text{mol. wt.})/d$, η and d being measured at the b.p. For monomerics R is \propto mol. crit. vol. It is, with some reservations (notably for H), const. for a given atom or group, and is additive. Vals. of R are given for 12 simple org. liquids, for which η and d vals. are determined.

H. J. W.

Structural mechanics of viscous-elastic systems. IV. Piezometry of viscosity. H. Umstätter (*Kolloid-Z.*, 1940, **92**, 169—179).—

An equation is deduced connecting η with pressure, and is tested with data obtained by Bridgman, with satisfactory agreement. For every liquid there is a characteristic internal pressure which decides the frictional strength of the liquid and is a definite multiple of the surface tension. This leads to the deduction of an equation of state for the liquid. The mol. wt. of a liquid can be calc. from the η -temp. and the η -pressure curves.

A. J. M.

Viscosity of natural gases.—See B., 1943, I, 439.

Influence of ionic radius and cation valency on fluidity of silicate melts.—See B., 1943, I, 448.

Viscosimetric investigation of higher fatty acids and triglycerides. G. B. Ravitsch (*Acta Physicochim. U.R.S.S.*, 1942, **17**, 55—72).— η for the C_{18} -fatty acids (linolenic, linoleic, oleic, and stearic) is linear with l val. (I); an equation giving η as $f(I, T)$ is obtained. $\eta = Ae^{B/RT}$ holds for the above and for palmitic acid, triolein, tristearin, tripalmitin, and hydrogenated sunflower oil. The liquid structure of these compounds is discussed in relation to H bonding and mol. aggregation. The temp.-dependence of η for hydrogenated sunflower, mustard, cottonseed, linseed, dolphin, and seal oils is investigated. Hydrogenated cottonseed oil shows a decrease in η to a limit with increase in rate of flow. After irradiation with ultra-short waves η for castor oil increases, and shows a variation with time of flow and an increased temp.-dependence.

J. H. BA.

Self-diffusion of copper. C. L. Raynor, L. Thomassen, and L. J. Rouse (*Trans. Amer. Soc. Met.*, 1942, **30**, 313—325).—Radioactive Cu, prepared by bombardment with deuterons in a cyclotron, was dissolved, introduced into a cyanide plating bath, and deposited (mixed with ordinary Cu) to a thickness of 0.0015 — 0.003 in. on the surface of a Cu block. Intensity measurements were made of the β -rays emerging from the plated surface before and after heating for various periods at 650° , 750° , and 850° ; coeffs. of self-diffusion of Cu at these temp. are calc. to be 3.20×10^{-12} , 2.49×10^{-11} , and 2.62×10^{-10} cm.² per sec., respectively.

J. C. C.

V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

Refractive indices of hydrogen peroxide and its aqueous solutions. P. A. Giguère (*Canad. J. Res.*, 1943, **21**, B, 156—162).—Vals. of n_D , n_F , and n_g at 16° , 20° , 24° , and 28° are tabulated and vals. of other physical consts. have been calc. from the data.

C. R. H.

Supersaturation limits of solutions. I. R. Gopal (*J. Indian Chem. Soc.*, 1943, **20**, 183—188).—When saturated solutions of certain inorg. Na and K salts are cooled under controlled conditions the difference between the temp. of saturation (T_s) and the temp. of spontaneous crystallisation (T) is approx. const. for a given solute. For monobasic salts of Na and K the mol. heat of dissolution $\propto 1/(T_s - T)$. The val. of $T_s - T$ for solutions of $Ba(NO_3)_2$, NH_4Cl , $(NH_4)_2SO_4$, $H_2C_2O_4$, $CO(NH_2)_2$, and succinic acid increases as the solutes are successively redissolved and recryst. Certain salts show no spontaneous crystallisation.

C. R. H.

Colloid osmotic pressure of mixtures of protein and thymus-nucleate.—See A., 1943, III, 914.

Diffusion [of ions] in glass.—See B., 1943, I, 448.

Magnetic evidence regarding the valency of colourant ions in glass. II. N. A. Yajnik, Ram Chand, and D. C. Jain (*J. Indian Chem. Soc.*, 1943, **20**, 169—170; cf. Bhatnagar *et al.*, A., 1941, I, 8).—Magnetic susceptibility (χ) measurements and chemical analysis have been used to determine the valency of colourant Fe ions in reduced and oxidised glasses prepared from borax and $NaNH_4HPO_4$. Calculations of χ from analysis data and the Stoner-Van Vleck formula give good agreement with the experimental val. throughout. Agreement is best when the orbital moment l is regarded as quenched. Measurements of χ for Fe^{3+} ions in oxidised borax glass furnish the vals. $\theta = 2.3$, $\mu_B = 5.74$. The latter is in fair agreement with the theoretical val. of 5.9 (l quenched).

L. H. L.

Effect of gelatin on the solubility of thalious salts at 40° . W. G. Eversole and F. S. Thomas (*J. Physical Chem.*, 1943, **47**, 421—424).—Data for the solubility (s) of $TlCl$, Tl_2SO_4 , and $TlCNS$ at 40° in solutions of gelatin show that s increases with gelatin content (g) and that the increase in s for a given pH and g is greatest for $TlCNS$ and least for Tl_2SO_4 . The electrical condition of the gelatin seems to be of secondary importance in determining s .

C. R. H.

Distribution in systems with anomalous mixed crystals. I. Systems of the type NH_4Cl - $FeCl_3$ and NH_4Cl - $MnCl_2$ - H_2O . II. Systems of the type inorganic salt-organic dye. III. Equilibrium between anomalous mixed crystals and solution. E. M. Joffe and B. A. Nikitin (*Acta Physicochim. U.R.S.S.*, 1942, **17**, 93—105, 106—115, 116—124).—I. The distribution coeff. D of $FeCl_3$ between saturated solution and solid NH_4Cl (found by crystallising NH_4Cl in the presence of $FeCl_3$) is const. up to concns. of $FeCl_3$ $0.055M$, but below this D decreases, indicating a lower limit for mixed crystal formation. $MnCl_2$ is similar, with $D >$ for $FeCl_3$ and const. up to

$4 \times 10^{-6}M$. in $MnCl_2$. Experiments with radioactive Mn at lower concns. indicate a decrease in D . The results show a microdisperse structure for these systems.

II. The distribution coeff. D of crystal-ponceau (I) between the saturated solution and solid, on crystallising K_2SO_4 , is const. for the same initial concn. of (I) (amount of K_2SO_4 pptd. being varied), but decreases with this initial concn. Methylene-blue (II) is similar with $Ba(NO_3)_2$ solutions (D vals. < those of Chlopin and Tolstaja, A., 1941, I, 462) but here the dye is adsorbed on the crystals. Both are colloidal microdisperse systems.

III. The equilibrium for the distribution between saturated solution and crystals in the systems $NH_4Cl-FeCl_3$, K_2SO_4 -(I), $Ra(NO_3)_2$ -(I) and (II)- $Ba(NO_3)_2$ (A), and $Ra(NO_3)_2-Ba(NO_3)_2$ is approached slowly when the distributed component is stirred with the other component suspended in its saturated solution. (I) and $Ra(NO_3)_2$ distribute at equal rates in system (A), indicating that recrystallisation of $Ba(NO_3)_2$ is the governing factor and that anomalous mixed crystals can be in true equilibrium with the solution. (II) decreases the rate of distribution of $Ra(NO_3)_2$ in system (A) by adsorption on the crystals. J. H. BA.

Kinetics of sorption by grains. J. Zabeshinski (*J. Phys. Chem. Russ.*, 1943, 17, 32—44).—A cylinder, or a layer of cylinders, of activated anthracite C is kept in streaming air containing EtOH, and the rate da/dt of wt. increase is determined; then pure air is passed through, and the rate $-da_1/dt$ of desorption is measured. It is found that $da/dt = \beta(c_0 - c)$ and $-da_1/dt = \beta c_1$, c_0 being [EtOH] in air, c and c_1 the [EtOH] which would have been in equilibrium with the adsorbed amount a and a_1 , respectively. If the relation between a and c (i.e., the adsorption isotherm) is known, the sorption and desorption rates can be calc. The agreement with experiment is satisfactory, and the const. β is identical for sorption and desorption. It is also independent of [EtOH] between 3 and 9 mg. per l. $\beta \propto v^{0.4}d^{-2}$, v being the velocity of air (between 75 and 1300 c.c. per sq. cm. per min.) and d the diameter of the cylinder (0.14—0.2 cm.). Vals. of β for birch charcoal and for fruit-stone charcoal differ from that for anthracite C by only 30—40%. These results agree with the theory that β depends mainly on the external diffusion. Sorption isotherms are determined also for H_2O , MeOH, Pr^iOH , and Pr^oOH . H_2O is the only substance the desorption of which is more rapid than the sorption. J. J. B.

(i) Absolute method for determination of the area of a fine crystalline powder. (ii) New adsorption isotherm valid over a very wide range of pressure. (iii) Adsorption method for the determination of the area of a solid without the assumption of a molecular area, and the area occupied by nitrogen molecules on the surfaces of solids. W. D. Harkins and G. Jura (*J. Chem. Physics*, 1943, 11, 430, 430—431, 431—432).—(i) The powder particles are coated with a layer, several mols. thick, of a liquid having zero angle of contact with the solid, by condensation of saturated vapour on the outgassed powder. The wetted powder is immersed in the liquid and the surface energy change measured calorimetrically. The surface energy of the adsorbed liquid film is assumed equal to that of the liquid.

(ii) The adsorption isotherm $\log p/p_0 = B - A/v^2$ gives much better agreement than that (I) of Brunauer, Emmett, and Teller (A., 1938, I, 190) with experimental data for the vol. (v) of N_2 adsorbed on TiO_2 (anatase) powder up to ~ 600 mm. pressure (p). At higher p , both isotherms give too high vals.

(iii) Areas of surface calc. from the above equation agree with those calc. from (I) within $\pm 9\%$ for 56 non-porous and 4 porous solids. For 60 solids, vals. calc. for the area occupied by an adsorbed N_2 mol. lie between 13.6—16.9 sq. A., with most frequent vals. 14.0—14.1, 15.2—15.3, and 16.2—16.3. L. J. J.

Disperse structure of solid crystalline systems, and its thermodynamic basis. III. D. Balarev (*Kolloid-Z.*, 1940, 92, 179—182).— CaF_2 , $CaCO_3$, and $BaCO_3$ were heated to various temp. and the adsorption of dyes (Congo-red, tropæolin OOO, and hæmatoxylin) on the powders was studied. The results indicate that the processes are reversible, in agreement with former work (cf. A., 1942, I, 391). A. J. M.

Definition of surface tension. G. Antonoff (*J. Physical Chem.*, 1943, 47, 463—464).—Surface tension and interfacial tension should not be defined as force per unit length at right angles to the surface or as force per unit area tangential to the surface as is often done, but as force per unit length tangential to the surface or, alternatively, as work per unit area. C. R. H.

Contact angles. E. J. Irons (*Phil. Mag.*, 1943, [vii], 34, 614—624).—By a combination of the methods of Ferguson and Dowson and of Jäger for the measurement of surface tension it is possible to evaluate the (receding) contact angle θ of a liquid in a capillary tube. Results for H_2O , C_6H_6 , CCl_4 , $COMe_2$, NH_2Ph , and pinene in contact with Al, Fe, Ni, Cu, Ag, and Pt, and for these liquids and AcOH, cyclohexanone, Et_2O , and liquid paraffin in contact with glass, show that in every case $\cos \theta = 1$ to a few parts in 1000. H. J. W.

Relation between surface tension and vapour pressure of liquids and liquid mixtures. R. C. Tripathi (*J. Indian Chem. Soc.*, 1943, 20, 197—199).—An equation on the type $\log p = A + B/(C - \gamma)$ satisfactorily represents the variation of v.p. (p) with surface tension (γ). Vals. for the consts. A , B , and C are recorded for 18 inorg. and 34 org. liquids. The equation is applicable to liquid mixtures and vals. of A , B , and C for $Et_2O-C_6H_6$, $CCl_4-C_6H_6$, and $AcOH-C_6H_6$ mixtures have been calc. C. R. H.

Surface activity of some sodium sulphonate solutions, and chemical constitution of the hydrocarbon radical. N. Turkiewicz (*Kolloid-Z.*, 1940, 92, 208—217).—Naphthenesulphonates with a primarily bound sulphone group, unlike the alkanesulphonates of corresponding mol. wt., are readily sol., crystallise well, and show a distinct capillary activity. Sulphonates with a cyclopentane ring substituted with short aliphatic side-chains are particularly active. Derivatives of cyclopentane are more active than those of cyclohexane. Sulphonates with a cyclopentane ring have min. in the surface tensions of their aq. solutions. These min. are displaced towards smaller concns. with increasing mol. wt. Naphthenesulphonates prepared from naphthenic acids by replacement of CO_2H by CH_2SO_3Na are considerably more active than the usual technical surface-active substances. A. J. M.

Condensation in the form of clouds and dew. J. W. Archbold (*Phil. Mag.*, 1943, [vii], 34, 632—642).—Statistical mechanics are used for the determination of the size distribution of drops in clouds subject to gravity. In the absence of electrical charges the drops tend to be large, with a min. size agreeing with Kelvin's result for the stability of single drops. When there are charges, a cloud of small drops may also occur. The distribution law for dew-drops is of a similar type to that for drops in a cloud. H. J. W.

Dragging of a liquid by a moving plate. L. Landau and B. Levitsch (*Acta Physicochim. U.R.S.S.*, 1942, 17, 42—54).—Expressions derived for the thickness (h) of the liquid layer carried along by a plate moving through the liquid take the forms: (1) $h = A(v\eta)^{2/3}/\gamma^{1/6}v(\rho g)^{1/2}$ for small vals. of v , the velocity of the plate, (2) $h = \sim A v \eta / \rho g$ for large vals. of v , and (3) $h = (v\eta/\rho g)^{1/2} f(v\eta/\gamma)$ for intermediate vals., the last function, and the numerical const. A , having to be determined by experiment. η , γ , and ρ are the viscosity, surface tension, and density of the liquid. J. H. BA.

Film formation by pure liquids. C. W. Foulk and J. E. Barkley (*Ind. Eng. Chem.*, 1943, 35, 1013—1016).—The ease of film formation with H_2O , Et_2O , $COMe_2$, and MeOH decreased to zero as the liquids were purified and, in the case of the org. liquids, traces of H_2O were removed. NH_2Ph did not form films even before purification, and repeated purification of $n-C_7H_{16}$ did not reduce film formation to zero. C. R. H.

Determination of mol. wt. of organic substances by dialysis. H. Spandau and W. Gross (*Ber.*, 1941, 74, [B], 362—373).—Membranes of "Cellophane 300" and of "Cuprophane 15," recommended by Brintzinger (A., 1931, 416) for determining mol. wts. by dialysis, are unsuitable since the val. of $\lambda\sqrt{M}$ (λ = dialysis coeff., M = mol. wt.), which should be const., decreases with increasing M . Satisfactory results are obtained with "Cello-filters 100 sec." in which the average pore radius is 25 times that of the other membranes. Experiments with 8 org. non-electrolytes with M ranging from 46 to 584 indicate that "Cello-filters" give M with an accuracy of $\pm 3\%$, whilst the results with Cellophane and Cuprophane membranes are completely misleading. Measurements of the mol. wt. of digitalin and digitonin in aq. solution give vals. twice as great as those recorded in the literature. F. L. U.

Permeability of porous solids to gases and liquids.—See B., 1943, I, 426.

Permeability through sugar-beet membranes.—See A., 1943, III, 838.

Electroviscous effect. B. N. Finkelstein and M. P. Tschursin (*Acta Physicochim. U.R.S.S.*, 1942, 17, 1—13).—A formula is derived for the viscosity of colloidal solutions, taking into account the diffuse ionic atm., its deformation with flow, and the reverse action of the cataphoretic potential. J. H. BA.

Streaming double refraction and double diffraction of herapathite suspensions. H. H. Pfeiffer (*Kolloid-Z.*, 1940, 92, 182—188).—Flow experiments with herapathite suspensions, carried out with a Diesselhorst and Freundlich flow-chamber, indicate that double refraction increases with increasing flow-gradient, up to a saturation limit. This shows the suspension to have a high η . Streaming double refraction increases with concn. and depends on the previous history, age, coloration, and mechanical treatment of the suspension. During flow, the disc-shaped particles orient themselves parallel to the broad side of the chamber. This is also indicated by investigation of double diffraction. The degree of polarisation depends on the degree of aggregation of the particles, and on their symmetry, n , and absorption coeff., and on those of the medium.

It also depends on the concn. and degree of hydration of the suspension, and on the λ of the transmitted light. A. J. M.

Dielectric measurements on pigment-linseed oil suspensions. Determination and computation of the dielectric constant of mixed systems. F. Wachholz and A. Franceson (*Kolloid-Z.*, 1940, 92, 75—93, 234).—The "Dielkometer" high-frequency resonance capacity-meter is described. Measurements of ϵ are carried out on the pigment suspended in a liquid of lower ϵ and repeated with one of higher ϵ . Typical vals. are given for a no. of common pigments. The most suitable frequency is 2×10^6 cycles per sec. A specially designed cell is described. Linseed oil-pigment systems show deviations from a linear ϵ -composition relation which can be calc. in an analogous manner to the conductivity of disperse systems. Geometrical models are given which provide a basis for the calculations described. The course of the ϵ -concn. curve is strongly dependent on the shape of the particles, but not on their size. Unsymmetrical particles give an orientational effect in flowing systems. L. J. J.

Relations between electrical conductivity and degree of dispersion of lyophilic colloids. I. General. E. Angelescu. **II. Conductivity of sodium and potassium palmitate and stearate solutions in presence of *o*-cresol.** E. Angelescu and A. Woinarosky (*Kolloid-Z.*, 1940, 92, 94—98, 99—105).—I. Factors affecting electrical conductivity (κ) in colloidal electrolyte solutions, e.g., soap solutions, are reviewed. Soap solutions with addition of varying proportions of cresols provide suitable systems for the study of the effect of ionic dispersity and solvation on κ .

II. The conclusions of the foregoing paper are tested by measurements of κ in Na and K stearate and palmitate solutions at concns. 0.1 and 0.2N. and temp. 20—60°, with and without addition of *o*-cresol. All four soaps show a max. val. of κ with increasing cresol concn.; the max. is the more pronounced the greater is the colloidal character of the soap, and its form is independent of concn. and temp. The effect of $\cdot\text{CH}_2\cdot$ chain length is $>$ any effect of differing ionic mobility or dissociation const. The effect of change of cation is marked with stearates but inappreciable with palmitates. The effect of dilution is inappreciable except with Na stearate, for which Λ increases with dilution. L. J. J.

Effect of hydrogen-ion concentration on the time of setting of thorium phosphate gel-forming mixtures. (Miss) A. Nathan (*J. Indian Chem. Soc.*, 1943, 20, 159—165).—The method of Hurd and Letteron (A., 1932, 464) has been employed to determine the time of setting, t , of Th phosphate gel-forming mixtures, prepared from $\text{Th}(\text{NO}_3)_4$ and varying quantities of H_3PO_4 and HCl, at 35° and pH vals. < 1.7 . Above this val. pptn. without gel-formation occurs. In all cases, for const. amounts of H_3PO_4 , the effect on t of decreasing the pH was to cause first an increase, then a decrease to a min., and finally a continuous increase. The pH at the min. was observed to decrease as the proportion of H_3PO_4 decreased. The concns. of the two acids at the min. exhibited a linear relationship. The pH-log t relationships were not linear as they are with silicic acid (cf. Hurd *et al.*, A., 1934, 730). Increasing the pH with NaOH increased t until pptn. occurred. The presence of increasing amounts of EtOH, while not affecting the pH, increased t to a max. followed by a decrease. In no case was the pH observed to have changed after gelation. L. H. L.

Time of setting and changes in hydrogen-ion concentration during the setting of gels formed by the interaction of oppositely charged sols. II. Interaction of nickel hydroxide and manganese dioxide sols with aluminium hydroxide sol. M. Prasad and S. D. Mehta (*J. Indian Chem. Soc.*, 1943, 20, 166—168; cf. A., 1943, I, 180).—The method of Hurd and Letteron (A., 1932, 464) has been employed to determine the time of setting, t , of the gels obtained by mixing positively charged $\text{Al}(\text{OH})_3$ sol with negatively charged sols of $\text{Ni}(\text{OH})_2$ and MnO_2 at 35°. The gels formed were transparent and thixotropic. For a const. vol. of $\text{Ni}(\text{OH})_2$ or MnO_2 sol, $t = Rv^{-m}$, where v is the vol. of $\text{Al}(\text{OH})_3$ sol and R and m are const. (cf. Prasad and Hattian-gadi, A., 1929, 1235). Electrometric measurement showed that no appreciable change of pH occurred during gelation. L. H. L.

Ageing of alumina and silica gels and the precipitates obtained from mutual coagulation of alumina and silicic acid sols. S. P. Raychaudhuri and A. H. Miah (*J. Indian Chem. Soc.*, 1943, 20, 195—196).—Freshly prepared gels of SiO_2 , Al_2O_3 , and aluminosilicates have a smaller buffer capacity than gels which have been aged for 1 year. The buffer capacity of aged gels increases as $\text{SiO}_2/\text{Al}_2\text{O}_3$ increases, whereas the buffer capacity of fresh gels rises to a max. as $\text{SiO}_2/\text{Al}_2\text{O}_3$ increases, max. capacity occurring when $\text{SiO}_2/\text{Al}_2\text{O}_3 = 3$. C. R. H.

Reactions of solids. CXXII. Processes occurring in a kaolin on gradual heating in presence of air and other gases. G. F. Hüttig and E. Herrmann (*Kolloid-Z.*, 1940, 92, 9—35).—Measurements of solubility in HCl and H_2SO_4 , and of sorption of MeOH, HCl, SO_2 , and dyes, are recorded for preps. of kaolin after treatment with air, H_2O vapour, O_2 , N_2 , NO_2 , HCl, and SO_2 at varying pressures and temp. up to 700°. The order of decreasing catalytic activity for

dehydration of kaolin in the presence of gases is (NO_2 , HCl), $4\text{NO}_2 + \text{O}_2$, O_2 , N_2 (inactive), H_2O (inhibitory). H_2O acts by displacing the equilibrium. L. J. J.

Constitution of dilute soap solutions. III. Theory of hydrolysis. P. Ekwall (*Kolloid-Z.*, 1940, 92, 141—157; cf. A., 1937, I, 78; 1938, I, 618).—The activity of OH' of soap solutions is nearly const. at high concns., and the degree of hydrolysis in a range almost coincident with that between the limiting and crit. concns. increases instead of decreasing. The products of hydrolysis are: below the limiting concn., the fatty acid; between the limiting and crit. concns., a cryst. acid soap with 1 mol. of soap to 1 mol. of fatty acid, and cryst. liquid acid soap with 2 mols. of soap, 1 mol. of fatty acid, and x mols. of H_2O ; and above the crit. concn., colloidal acid soaps. Above a concn. of 0.1N., both the hydrolysis products and the soap are associated. The theory that the ions of the fatty acid associate in a step-wise manner, and are then hydrolysed, the hydrolysis occurring the more readily the higher is the degree of association, is examined in detail. Different hydrolysis products are formed at different stages of the association of the anions. The hydrolysis curve breaks up into several sections, each with its own equilibrium. Within each section, the course of the curve depends on the initial association, the hydrolysis const. and the solubility of the products. Narrow transition ranges separate the main sections. An attempt is made to obtain equations for the OH' activity and degree of hydrolysis in the different sections. Below the limiting concn. where the soap acts as a normal electrolyte, the degree of hydrolysis decreases with increasing concn. in the usual way, until the solution is saturated with fatty acid, when it becomes const. At the limiting concn. double ions begin to form. After a narrow transition range, in which the fatty acid disappears, the second main section begins, in which the acid soap, NaL.HL (L = fatty acid radical), and its ions predominate. Just below the crit. concn. the association reaches a new stage, but the nature of the anions in this region is not definitely known. At higher temp. triple ions exist, whilst at lower temp. triple or quadruple ions are formed. Beyond the crit. concn. the degree of association increases rapidly. The course of the hydrolysis in this region is considered in detail. A. J. M.

Solid soap phases. R. H. Ferguson, F. B. Rosevear, and R. C. Stillman (*Ind. Eng. Chem.*, 1943, 35, 1005—1012).—The application of X-ray diffraction methods to the identification and determination of the proportions of α , β , δ , and ω solid soap phases in Na soaps is described. The δ and ω phases have not hitherto been recognised, although the ω phase is possibly the same as the γ structure of Na stearate mentioned by McBain and de Bretteville (cf. A., 1943, I, 147). Much of the evidence for the ω phase has been mistakenly attributed to β , but examination of the phase has established ω as a separate structure. Formation of the ω phase is favoured by high temp., low H_2O content, and low mol. wts., whereas the formation of δ phase is favoured by low temp., low soap content, and high mol. wts. The influence of the four phases on the properties of soaps is discussed. C. R. H.

Structure of rubber. R. Houwink (*J. Physical Chem.*, 1943, 47, 436—442).—Modern ideas on the structure of raw and vulcanised rubber are discussed. The exponent n in Kuhn's equation ($\eta_{sp} = KcM^n$, where c = concn., η_{sp} = sp. viscosity, M = real mol. wt. determined osmotically, K = const.) is a measure of the degree of compactness of the "knäuels." The calc. val. of n for raw rubber is 1.6, indicating a very loose "knäuel." Diagrams illustrating the structure of raw and vulcanised rubber are presented. C. R. H.

Colloid-chemical and physical properties of starch solutions as guides to the study of its organic structure. M. Samec (*Kolloid-Z.*, 1940, 92, 1—8).—The effect of P content on the viscosity of potato starch solutions is examined. Electrodialysis separates such solutions into sol and gel phases, the P content being conc. in the latter, which contains invariably $\sim 0.17\%$ P_2O_5 . The electrometric titration curve of the gel closely resembles that of H_3PO_4 . Natural phosphatases do not produce a similar separation. Acid and diastatic hydrolysis of the gel give fragments which on further electrodialytic separation give a higher P content in the gel phase. Phosphorylation of the P-free sol phase with POCl_3 gives a gel. Gels obtained from different forms of starch by electrodialysis differ widely in physical properties, but in a series of starches of different origin the P content, electrical conductivity, and $[\text{H}^+]$ show a parallel variation. P-rich starches (e.g., potato) show characteristic differences in X-ray spectrum from low-P starches (e.g., wheat). L. J. J.

Detection of acid groups in native cellulose by salt formation with crystal-violet base. M. Rebek (*Kolloid-Z.*, 1940, 92, 217—221).—To detect CO_2H groups in native cellulose, the latter is allowed to react with a colourless pseudo-base, which will combine with acid groups to form a dye. Cotton-wool was treated with the colourless base of crystal-violet in Et_2O , H_2O , C_6H_6 , and light petroleum, and after removal of excess of dye from the thread, the N content of the fibre was determined. The amount of dye taken up in C_6H_6 , H_2O , and light petroleum was practically the same (indicating 0.04%

CO₂H), but a lower val. was obtained in Et₂O, which is considered to be due to the inhibiting effect of Et₂O on the ionisation of the dye-base. The CO₂H vals. obtained are < those obtained by Schmidt by conductometric titration (0.282%) (A., 1935, 201), and this may be due to the fact that only strong CO₂H groups will react with crystal-violet base. A. J. M.

Degradation of cellulose fibres.—See B., 1943, II, 345.

Swelling of cellulose hydrates in the presence of protein substances. E. Elöd and G. Schmitt (*Kolloid-Z.*, 1940, 92, 105—112).—The effect of addition of varying proportions of gelatin (I), casein (II), and haemalbumin (III) to cellulose xanthate solutions on the swelling of viscose films made from them, in air at const. R.H., has been examined. With (I), swelling has a sharp min. val. at 10% (I), and rises with increasing concn. of (I) to a val. > that for cellulose. With (II), swelling is a min. with 50% (II). The effect of (III) is similar to that of (I) and (II). In all cases, films treated with CH₂O show decreasing swelling with increasing protein content. The tanning effect of CH₂O, Cr^{III}, Ce^{III}, and Zr^{IV} is a max. at pH 5, and gives greatly increased stability to H₂O at 100°. L. J. J.

Electrodialysis-electrophoresis apparatus for preparative colloid-chemical purposes. O. Dahl (*Kolloid-Z.*, 1940, 92, 70—75).—A three-chamber apparatus consisting of anode- and cathode-cells and electrodialysis-electrophoresis vessel is described. It permits simultaneous electrodialytic purification and electrophoretic fractionation of colloidal systems. Fractionation results for separation of amylose and amylopectin from starch are given. L. J. J.

Coagulation of colloids by electrolytes. XV. Electrochemical and chemical investigations on monodisperse gold sols. V. N. Volkov and A. J. Rabinovitsch. **XVI. Electrophoresis cell and measurements on monodisperse gold sols.** A. J. Rabinovitsch and V. N. Volkov (*Acta Physicochim. U.R.S.S.*, 1942, 17, 14—24, 25—41).—XV. Zsigmondy Au sols show a decrease in κ and an increase in pH on dialysis. Displacement of H⁺ by added salts reaches a limiting val. (Al > Ba > K) and the amounts displaced are equiv. to the amounts of adsorbed cations. Titration of an undialysed sol with AgNO₃ and VOSO₄ indicates the presence of unreduced Au compounds (H₂AuCl₃O) adsorbed on the particles (not removed by ultrafiltration).

XVI. Improvements on the electrophoresis cell of Smith and Lisse (A., 1936, 697) are described and the theory is confirmed. Dialysed Au sols show a decrease in mobility and ζ on addition of KCl, BaCl₂, and AlCl₃, to a limit corresponding to max. H⁺ displacement. The effect of HCl on ζ is > of KCl, while NaOH gives a ζ -concn. curve with a flat max. In general the decrease in ζ for non-dialysed sols is less but KCl, HCl, and NaOH all give ζ -concn. curves with small max. Changes in ζ are accounted for by variations in the electrolytic dissociation. The theory of Müller (cf. A., 1928, 1322) is applicable only when the H⁺ displacement (KCl and dil. BaCl₂ but not AlCl₃) (cf. A., 1939, I, 610) is very small. Calculations of radii of particles on this theory agree with the counting method, but the calc. charge differs widely from the titration val. J. H. Ba.

Mechanism of the mutual coagulation process. III. H. B. Weiser and W. O. Milligan (*J. Physical Chem.*, 1943, 47, 424—436).—On mixing two hydrophobic sols of opposite sign of charge, mutual adsorption of the oppositely charged particles takes place with lowering of the ζ -potential (or mobility) of the mixed particles, accompanied in most cases by displacement of the counter ions of the double layer surrounding the particles of the respective sols. Fe₂O₃ was used as positive sol, the stabilising ions being H⁺ and Fe⁺⁺⁺ and the counter ion Cl⁻, and Cu₂Fe(CN)₆, SnO₂, As₂S₃, and Congo-red acid were used as negative sols. The behaviour of each sol pair is described. C. R. H.

Electrophoretic study of action of alkylbenzenesulphonate detergents on ovalbumin.—See A., 1943, III, 838.

VI.—KINETIC THEORY. THERMODYNAMICS.

Equilibrium in hydrogen-water systems containing tritium. J. F. Black and H. S. Taylor (*J. Chem. Physics*, 1943, 11, 395—402).—Equilibrium measurements over a Pt-charcoal catalyst at 289—576° K. give for the reaction $\text{HT} + \text{H}_2\text{O} = \text{H}_2 + \text{HTO}$: $\log K = 0.292 \log T + 336.5/T - 1.055$, $\Delta F^\circ = 4.83T - 1.34T \log T - 1540$, $\Delta H^\circ = 0.58T - 1540$, $\Delta S^\circ = 1.34 \log T - 4.25$, $\Delta C_p^\circ = 0.58 \pm 0.05$ g.-cal. per degree per mol., $\Delta H_p^\circ = -1540 \pm 160$ g.-cal. per mol., $I = -1.055$, in agreement with Libby's calculations (A., 1943, I, 175) and the assumption that force fields are unaffected by nuclear mass changes. L. J. J.

Magnetic study of colour changes in copper chloride. N. A. Yajnik, R. Chand, and D. C. Jain (*J. Indian Chem. Soc.*, 1943, 20, 203—206).—The change of magnetic susceptibility with temp. and with changes in [Cl⁻] has been investigated for 5% solutions of CuCl₂, [Cl⁻] being varied by addition of HCl. At 35° the colour of the solution changes from blue to green as [HCl] is raised beyond 4N.

At higher temp. this colour change occurs at lower [HCl], thus showing that rise in temp. brings about the same change as increase in [Cl⁻]. The data support the view that the colour change is due to complex ion formation. C. R. H.

Absorption spectrum of reversible polymers of quinoline dyes. H. Ecker (*Kolloid-Z.*, 1940, 92, 35—70).—An apparatus for the measurement of absorption spectra of dye solutions in the range 4600—6800 Å. with an accuracy within 2—3% is described. The spectral data recorded for aq. solutions of dyes consisting of two variously substituted mols. of quinoline or indole linked through one or more CH show a variation with temperature and concn., attributable to reversible polymerisation by a co-ordination mechanism. Polymerisation leads by way of double mols. to highly polymerised, fluorescent, thixotropic, viscous and elastic products, while a sharp narrow absorption band appears. H₂O and D₂O solutions show these effects, but not H₂S, NH₃, HCN, or EtOH as solvents. The heat of polymerisation is ~7 kg.-cal. per single mol. Strong mol. resonance effects are shown by the absorption band referred to. L. J. J.

Thermal analysis of binary systems. H. Rheinboldt (*Ber.*, 1941, 74, [B], 756—758).—A claim for priority over Kofler and Wannemacher (*ibid.*, 1940, 73, 1388). F. L. U.

System silver nitrate-water. A. N. Campbell and M. L. Boyd (*Canad. J. Res.*, 1943, 21, B, 163—169).—The temp.-concn. diagram for the system from 0 to 100% of AgNO₃ and from -7° to 195°, which has been determined with a degree of accuracy > hitherto employed, confirms the eutectic at -7.57° and 46.9% of AgNO₃ and the break in the curve at ~159° corresponding with the rhombic \rightleftharpoons rhombohedral transformation of AgNO₃. C. R. H.

System *n*-hexane-methylcyclopentane-amine. B. de B. Darwent and C. A. Winkler (*J. Physical Chem.*, 1943, 47, 442—454).—The system has been investigated at 25.0°, 34.5°, and 45.0°, and the data are recorded in tabular and diagrammatic form. The methods which yielded straight consolute lines for the system *n*-C₆H₁₄-methylcyclohexane-NH₂Ph have been applied to the present system with satisfactory results for mixtures which contain large amounts of *n*-C₆H₁₄ and are far removed from the plait point. The val. of $\beta = y_n x_p / y_p x_n$ (y_n and x_n are mol. fractions of naphthene in solvent and in *n*-C₆H₁₄ respectively and y_p and x_p are the mol. fractions of *n*-C₆H₁₄ in solvent and in *n*-C₆H₁₄ layer respectively) is reasonably const., not only for tie lines at each temp. but also over the temp. range investigated. C. R. H.

Behaviour of hydroxyapatite in solutions. R. Klement and R. Weber (*Ber.*, 1941, 74, [B], 374—386).—3Ca₃(PO₄)₂·Ca(OH)₂ (I) does not dissolve congruently in H₂O. At 25° the amounts of Ca and PO₄ in solution increase with the proportion of solid phase present, and the ratio Ca:PO₄ varies from 1:1 to 1:1.26. For a given solid:liquid ratio the total quantity dissolved decreases slightly with rise of temp., with a min. at 40°, at which temp. the ratio Ca:PO₄ is a min. (1:1.46). The solubility of (I) in aq. NH₂-acids is > in H₂O, and is much greater in 1% aq. gelatin. When (I) is shaken with Tyrode's (Ringer) solution the amounts of Ca and PO₄ in solution decrease, the decrease being smaller in presence of 1% gelatin. Solutions of org. acids have a strong solvent action on (I), lactic acid being the most effective of those studied. Electrical conductivities and diffusion coeffs. are recorded for some of the solutions. F. L. U.

Thermochemical study of processes taking place during heating of kaolin. B. S. Schvetzov and C. O. Gevorkian (*J. Appl. Chem. Russ.*, 1942, 15, 302—318).—Certain exothermic effects suggested by the heating curve of kaolin are, on the basis of a study of the X-ray spectra of the products, and of their heat of dissolution in HF, interpreted as being due to formation of metakaolin at <900°, to its decomp., with crystallisation of γ -Al₂O₃, at 900—1050°, and to formation of mullite at 1200—1300°. R. T.

Heat of formation of iron disulphide. S. V. Lipin, V. S. Uskov, and V. R. Klokman (*J. Appl. Chem. Russ.*, 1942, 15, 411—421).—Pyrite and marcasite, both containing >1% of SiO₂ and other admixtures, gave in a calorimetric bomb the heats of combustion to Fe₂O₃ and SO₂ of 188.4 and 194.0 kg.-cal. per g.-mol., respectively. The error, mainly due to the chemical inhomogeneity of the material, was ± 1.5 kg.-cal. The difference between the heats of formation of pyrite and marcasite is, therefore, real. J. J. B.

Thermodynamics of humic acid reactions. The systems humic acid-calcium acetate-water, and methoxyhumic acid-calcium acetate-water. W. Fuchs (*Fuel*, 1943, 22, 112—116).—The equilibrium conditions of the above systems have been investigated. On the assumption of a homogeneous system the mass action law was applied and the thermodynamic equilibrium const., heat of reaction, and changes of free energy were computed. On the assumption of a heterogeneous system, the distribution law was applied, and distribution coeffs. and the thermal effects of phase distribution were computed. The results obtained by these two different methods of approach checked reasonably well. H. C. M.

VII.—ELECTROCHEMISTRY.

Conductivity of adsorptive charcoal. G. M. Schwab and B. Karkalos (*Z. Elektrochem.*, 1941, 47, 345—353).—The electrical conductivity of commercial forms of active charcoal is increased considerably during the adsorption of vapours, particularly Br. At const. C vol. the effect is independent of the rate of passage of Br vapour or its concn., and with rise of temp. decreases in proportion to the amount of Br adsorbed. With const. external pressure on the C the effect is independent of temp. and increases with increasing pressure. The changes observed are $> \propto$ the vol. changes of the C particles, and are explained by assuming that on adsorption of Br the vol. of the C increases reversibly, whilst its modulus of elasticity decreases reversibly. J. W. S.

Contact potential difference between mercury and thallium amalgam. S. Karpatshev and A. Stromberg (*J. Phys. Chem. Russ.*, 1943, 17, 1—3).—The characteristics of two two-electrode thermionic valves are compared, the anode of one being a thin stream of Hg, and of the other a similar stream of 12% Tl amalgam. The voltage difference between the characteristics is 0.35—0.42 v. This agrees with the difference between the potentials of the electrocapillary max. of Hg and of Tl amalgam (cf. A., 1941, I, 81). J. J. B.

Passivity of platinum. B. V. Erschler (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 226—229).—The velocity of dissolution of a Pt electrode in HCl depends on the potential of the electrode and [Cl]. F. R. G.

Electrochemical mechanism of passivation of platinum. B. V. Erschler (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 230—232).—Retardation of dissolution of Pt by O is attributed to a weakening of the field of the double layer owing to displacement of Cl by O. F. R. G.

E.m.f. measurements in liquid sulphur dioxide. K. Cruse (*Z. Elektrochem.*, 1941, 47, 411—413; cf. A., 1943, I, 229).—Reasons for preferring Brønsted's definition of acids and bases to that of Wickert (A., 1937, I, 306; 1943, I, 258) are detailed. J. W. S.

Relation between the height of the polarographic wave of a cation and the concentration of the background. T. A. Kriukova (*Zavod. Lab.*, 1940, 9, 699—702).—The height of the polarographic wave of, say, 0.0005M-Pb²⁺ in KCl solution depends on [KCl]. This is due to movements of solution near Hg drops as the rate v of the movement depends on the nature and concn. of the "background electrolyte." If this concn. is $> 1N$, v is independent of the salts present in small concns. The current increase Δi due to v is $\propto vC$, C being the concn. of, say, Pb²⁺. If v for a given background electrolyte is known for all polarising voltages, C can be calc. by measuring the height of the Pb wave without and in presence of gelatin which reduces v to zero. The calculation gives correct results for Pb, Cd, Mn, Co, Fe, Cr, and Th in saturated KCl. J. J. B.

Hydrogen overpotential in alkaline electrolytes under reduced pressure. G. Schmid and E. K. Stoll (*Z. Elektrochem.*, 1941, 47, 360—368).—The H-overpotential (η) at Cu, Ni, Pb, Ag, Fe, Zn, and Sn cathodes in 0.1N-NaOH has been measured at c.d. 10^{-2} — 10^{-4} amp. per sq. cm. and at H₂ pressure (p) 15—760 mm. For all metals η increases with decreasing p , the vals. for Cu, Ni, Pb, and Ag following the relation $\eta = \eta_0 - k \log p$. With the other metals no simple relationship has been derived. The cathode potential relative to a non-pressure-dependent auxiliary electrode is for Cu, Ni, Pb, and Ag independent of p and the variation of η is therefore due only or principally to the variation of the equilibrium potential of the auxiliary H₂ electrode. It is suggested that, since the electrode reaction is under these conditions almost unidirectional, it is to be expected that the kinetics of the reaction will be independent of the concn. of the products, i.e., the cathode potential is independent of p whereas the potential of the reference electrode varies with p in the usual way. J. W. S.

Polarographic study of cis-trans isomerism of azo-compounds.—See A., 1943, II, 361.

VIII.—REACTIONS.

Temperature, pressure, and specific volume changes of a gas under dissociation and re-association conditions. W. J. Walker (*Phil. Mag.*, 1943, [vii], 34, 486—488).—Mathematical. The temp. and pressure of explosion of a mixture of fuel and air have been computed, taking dissociation into account. The method applies to the re-association correction required for temp., pressure, and sp. vol. changes during the subsequent expansion. W. R. A.

Kinetics of the thermal decomposition of *n*-propyl and isopropyl formates. R. B. Anderson and H. H. Rowley (*J. Physical Chem.*, 1943, 47, 454—463).—The initial reaction in the thermal decomp. of HCO₂Pr^a and HCO₂Pr^b over the range 300—400° is decomp. to C₃H₈ and HCO₂H. HCO₂H then decomposes according to HCO₂H \rightarrow CO₂ + H₂, HCO₂H \rightarrow CO + H₂O, or 2HCO₂H \rightarrow CO₂ + CH₂O + H₂O according to surface conditions. The velocity coeffs. of C₃H₈

formation can be represented by $k = 2.94 \times 10^9 \times e^{-39,660/RT}$ for HCO₂Pr^a and $k = 2.47 \times 10^{12} \times e^{-44,230/RT}$ for HCO₂Pr^b. C. R. H.

Kinetics of the rearrangement of cis-trans-isomerides in the gaseous state under the influence of foreign gases. II. Dichloroethylene. B. Tamamushi, H. Akiyama, and K. Ishii (*Z. Elektrochem.*, 1941, 47, 340—345; cf. A., 1939, I, 151).—The conversion of cis- into trans-(CH₂Cl)₂ in the gaseous state has been followed at 200° by measurements of dielectric const. At const. partial pressure of (CH₂Cl)₂ the addition of foreign gas increases the unimol. velocity coeff., the effects of O₂ and NO being particularly marked and attributed to sp. catalytic action, whilst the effects of C₂H₆, CO₂, and N₂ are relatively small. In the absence of foreign gas the unimol. velocity coeff. k is dependent on the (CH₂Cl)₂ pressure at pressures < 80 mm., but is independent of this at higher pressure. The position of equilibrium ($\sim 60\%$ cis at 200°) is not appreciably affected by the addition of O₂, suggesting that its action is one of homogeneous catalysis. Comparative measurements of the rates of reaction at 200°, 225°, and 250° indicate that the heat of activation of the reaction is $\sim 16,000$ g.-cal. per g.-mol. J. W. S.

Reaction between chlorohydrins and ammonia or amines.—See A., 1943, II, 354.

Rates of dissociation of penta-arylethanes.—See A., 1943, II, 360.

Solid-phase inversions of calcium orthosilicate, constituent of dolomite-silica brick. S. Zerfoss and H. M. Davis (*J. Amer. Ceram. Soc.*, 1943, 26, 302—307).—The solid solution of P₂O₅ in 2CaO.SiO₂ (I) was studied by thermal and optical methods and the $\alpha \rightarrow \beta$ inversion point was found to be lowered by P₂O₅. The inhibition of the $\beta \rightarrow \gamma$ inversion of (I) by 1% of P₂O₅, B₂O₃, Cr₂O₃, As₂O₃, or V₂O₅ may be due to: (1) purely physical separation and restraint of the crystals by sufficient compatible cryst. or vitreous phase [this method is probably effective only in the case of bodies low in (I)], or (2) the crystal-chemical effect of a solid solution of certain acid oxides in the β form, their insolubility in the γ -form lattice, and their sluggish pptn. from the β form. This type of inhibition involves the preservation of part of the Ca atoms in a low co-ordination (i.e., 4 instead of 8 O neighbours). J. A. S.

Kinetics of reduction of Cu²⁺ to Cu⁺ by carbon monoxide in ammonia solution. E. I. Dontzova (*J. Appl. Chem. Russ.*, 1942, 15, 447—452).—A solution of CuCl₂ in 5.85N-NH₃ was kept under CO, and the e.m.f. between a Pt electrode immersed in the solution and a Hg/Hg₂Cl₂ electrode measured every 20—120 min. The [Cu⁺] calc. from this e.m.f. increases at first very slowly, then at almost const. rate up to $> 95\%$ of reduction. The first period is, e.g., 8 hr. at 24°, 5 hr. at 30°, 3 hr. at 41°, and 2 hr. at 49°, and the reduction is nearly complete within 24, 14, 9, and 8 hr., respectively. The autocatalytic progress of the reaction is attributed to formation of the CuCO⁺ ion which is the real reducing agent. J. J. B.

Olation of some chromium salts. A. Lottermoser, R. Schmied, and P. C. Chü (*Kolloid-Z.*, 1940, 92, 129—136).—Solutions of CrCl₃ to which had been added $\frac{1}{2}$ equiv. of NaOH were titrated conductometrically and potentiometrically with HCl back to the hexa-aquo-salt. The conductivity of the final solution was the same as that of a solution of [Cr(OH₂)₆]Cl₃ to which an equiv. quantity of NaCl had been added. It follows that the monohydroxo-salt gives the hexa-aquo-salt with acids without any side-reaction. pH determinations lead to the same result. The velocity of olation is small at 0°; at 50° a const. rate of olation is reached after 168 hr. Investigations with Cr chloride, nitrate, and perchlorate in aq. solution show that the anion is without effect on the velocity of olation. Olated solutions were titrated at 0° with equiv. amounts of HCl. Conductivity and pH determinations show that the acid is not used up. A. J. M.

Influence of oxygen and sulphur atoms on the velocity of hydrolysis of the carbon-halogen bond. H. Böhme (*Ber.*, 1941, 74, [B], 248—256).—Halogen atoms in compounds containing halogen and O or S linked to the same C atom are very reactive. Such substances often have pronounced physiological action, e.g., COCl₂, CSCI₂, (CH₂Cl)₂O, ClCO₂Et. Characteristic of all these substances is their hydrolysis by H₂O with formation of HHal. Qual. statements in literature appeared to indicate that O compounds were more stable than S compounds. The course of hydrolysis is studied for a no. of cases using 0.1M-dioxan solutions with varying amounts of H₂O and titrating the halogen acid with N(CH₂Ph)₃, using NMe₂.C₆H₄.N.NPh as indicator, a technique which is not interfered with by unchanged material. It is found that O compounds are much more easily hydrolysed than S compounds; e.g., half-time vals. are: 9 min. for CH₂Cl.OEt and 10 days for CH₂Cl.SET; 5 hr. for (CH₂Cl)₂O and 19 days for (CH₂Cl)₂S with 200-fold excess of H₂O at 25°. COCl₂ is hydrolysed much more rapidly than CSCI₂. The reactions are first-order reactions but in the case of α -halogenated ether and thioether an induction period is observed and the accumulation of a definite amount of HHal is necessary before a normal first-order reaction rate is observed. Electronic mechanisms are discussed. J. Wa.

Zone behaviour of enzymes.—See A., 1943, III, 842.

Ether-like compounds. XXIV. Synthesis and reaction velocities of higher ether-acids.—See A., 1943, II, 351.

Physico-chemical investigations of solutions in liquefied gases. XXIX. Catalytic activity of nitro-indicators in liquid ammonia. Salt effect in the ammonolysis of pilocarpine. E. A. Izrailevitch and A. I. Schattenschtein (*J. Phys. Chem. Russ.*, 1943, 17, 24—31).—The rate of ammonolysis of santonin in liquid NH_3 at 20—25° is almost unaffected by NEt_4Cl , $o\text{-NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{NEt}_2$, $p\text{-NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{NMeAc}$, $o\text{-NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{NHMe}$, $m\text{-NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{NH}_2$, or 2:4:1-(NO_2) $_3\text{C}_6\text{H}_3\cdot\text{NEt}_2$, and raised in the order $o\text{-NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{NH}_2$ (I) < $o\text{-NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{NHAc}$ < $m\text{-NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{NHAc}$ < 2:4:1-(NO_2) $_3\text{C}_6\text{H}_3\cdot\text{NH}_2$ < phenolphthalein < CH_2Ac_2 < $m\text{-NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{OH}$, 2:4:6:1-(NO_2) $_4\text{C}_6\text{H}_2\cdot\text{NH}_2$ < $p\text{-NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ (II); N-(I) raises the rate 4 times, and N-(II) 700 times. The catalytic activity increases with the acid strength of the catalyst. The rate of ammonolysis of pilocarpine in liquid NH_3 + 0.09N- NH_4NO_3 at 20° is raised by NaNO_3 (1.3 times) < LiNO_3 < $\text{Ba}(\text{NO}_3)_2$ < $\text{Sr}(\text{NO}_3)_2$ < $\text{Ca}(\text{NO}_3)_2$ (13.5 times for a N. solution). The salt effect of cations is the stronger the more "acid" is the cation.

J. J. B.

Preferential paths in contact catalysis. A. A. Balandin (*Acta Physicochim. U.R.S.S.*, 1942, 17, 73—81).—Calculations of the probabilities of reactions on Ni catalysts based on the multiplet theory (cf. A., 1929, 519; 1941, I, 341) are revised, using new bond strength data. The results (in general unchanged by the new data) agree with experiment. Several new reactions are considered on this basis.

J. H. BA.

Contact decomposition of hydrocarbons. Conversion of *n*-butane under the action of carbon dioxide over nickel-alumina catalysts. A. A. Balandin, M. N. Maruschkin, and M. M. Afanasiev (*Acta Physicochim. U.R.S.S.*, 1942, 17, 82—92).—With rise in temp. (θ) from 400° to 600°, $[\text{CO}]$ and $[\text{H}_2]$ of the product from C_4H_{10} and CO_2 over a Ni- Al_2O_3 catalyst increase, and the vol. increases tenfold. The hydrocarbon content is all CH_4 at 600° (amount decreasing with θ). For low initial CO_2 content, CH_4 is > original C_4H_{10} , indicating decomp. of C_4H_{10} , and decrease in the C and H content of products indicates decomp. to C. C_2H_6 is found in some experiments but is not due to pyrolysis since no olefines are produced. The results are explained on the multiplet theory (cf. preceding abstract). With the catalyst the C_4H_{10} first suffers rupture of a primary C-H linking followed by that of C-C to give H, CH_2 , and Pr. Pr and H recombine to give C_3H_8 , and CH_2 with CO_2 gives CO and H_2 . The shortened chain repeats the process (calculation shows it to be more favourable). Alternatively CH_2 gives C and H_2 , or is hydrogenated to CH_4 . CO_2 and PrCHO under similar conditions give olefines (amount increases with θ) as well as paraffins, but θ must be higher than with C_4H_{10} . This indicates that PrCHO is not an intermediate in the C_4H_{10} - CO_2 reaction.

J. H. BA.

Relationship between particle size and efficiency of palladium-polyvinyl alcohol (Pd-PVA) catalysts. L. D. Rampino, K. E. Kavanagh, and F. F. Nord (*Proc. Nat. Acad. Sci.*, 1943, 29, 246—256).—Pd-PVA was prepared by reducing PdCl_2 in PVA solution by H_2 or by allowing the slow reduction by PVA itself to proceed to completion. No appreciable difference of function was observed in the two preps. Electron micrographs showed no significant difference in particle size, the Pd being present mainly as hexagonal crystals. Partial separation of the particles by centrifuging revealed, in the comparison of rates of catalytic hydrogenation of PhNO_2 , that the activity was mainly associated with the particles of smaller size. Statistical evaluation of the particle size from electron micrographs indicated the existence of a rough quant. relationship between the catalytic activity and surface area. An additional quality factor is to be attributed to the superiority of the synthetic polymer-supported catalyst over the gum arabic-supported type.

L. H. L.

Catalytic hydrogenation of carbon monoxide: methane synthesis from water-gas.—See B., 1943, I, 437.

Nikel-chromic oxide catalysts for hydrogenation of peanut oil.—See B., 1943, II, 351.

Anodic polishing of lead.—See B., 1943, I, 457.

Photochemical decomposition of platinum complexes. I. Photochemical decomposition of the platinum complexes with oxalic acid and malonic acid. T. Banerjee, H. Chakravorty, and S. Sarker (*J. Indian Chem. Soc.*, 1943, 20, 207—212).—The photochemical decomp. of the complexes formed between H_2PtCl_6 and $\text{K}_2\text{C}_2\text{O}_4$ or $\text{CH}_2(\text{CO}_2\text{K})_2$ follows a unimol. course in blue light but in ultra-violet light the unimol. velocity coeffs. decrease with time. The val. of the ratio $[\text{CH}_2(\text{CO}_2\text{K})_2]/[\text{H}_2\text{PtCl}_6]$ ($= R$) affects the quantum yield (γ) in the second reaction. When R is ~ 3 γ is ~ 1 , but as R increases γ suddenly increases so that when $R = 6$ $\gamma = 4$ and an induction period appears. It is assumed that when R is > 3 some other complex is involved. Possible mechanisms are discussed.

C. R. H.

Mercury-photosensitised decomposition of *n*-butane. A. W. Hay and C. A. Winkler (*Canad. J. Res.*, 1943, 21, B, 149—155).—The Hg-photosensitised decomp. of *n*- C_4H_{10} at 100°, 175°, and 250° leads to the formation of H_2 , octanes, and dodecanes. Discussion of the

decomp. mechanism leads to the view that liberated H atoms react with unchanged C_4H_{10} to give Bu^\bullet and H_2 by rupture of a C-H linking, and that Bu^\bullet radicals then unite to form higher paraffins.

C. R. H.

IX.—PREPARATION OF INORGANIC SUBSTANCES.

Complex compounds of diguanide with bivalent metals. V. Copper and nickel *m*-phenylenebisdiguanidine and their salts.—See A., 1943, II, 361.

Air-free carbon dioxide from the Kipp apparatus for the Dumas nitrogen determination. R. Kraus (*Z. anal. Chem.*, 1943, 125, 405—406; cf. A., 1943, I, 321).—Merck's Na K carbonate cast into rods gives with 20% H_2SO_4 pure air-free CO_2 , containing no trace of H_2S , without any pre-treatment being necessary.

L. S. T.

Concentration of hafnium. Preparation of hafnium-free zirconia. E. M. Larsen, W. C. Fernelius, and L. L. Quill (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 512—515).—Zr and Hf can be satisfactorily extracted from cyrtolite by heating 1 part of the 200-mesh ore with 2 parts of conc. H_2SO_4 at a max. temp. of 210—220°, and pouring the cooled digest into 5 parts of H_2O . Acid solutions of dil. ZrO-HfO sulphate sprayed into 10% H_2SO_4 at 70—75° simultaneously with dil. H_3PO_4 yield a dense, compact ppt. that is easily filtered. Treatment of a cold slurry of the phosphates with ice-cold $\text{NaOH-Na}_2\text{O}$ solution, followed by digestion at 70° yields an acid-sol. hydrate. Conditions for the fractional separation of Zr and Hf by direct pptn. of the phosphates in dil. solution have been investigated. The mother-liquor from a partial pptn. of the total oxides as phosphate, when purified by oxychloride recrystallisation, gave Hf-free ZrO_2 . The Hf-free oxide prepared by ignition of the hydrated oxide at 900° has ρ 5.64. Details of procedure, including a method of analysis by ρ determinations of the ignited Zr-Hf oxides, are given.

L. S. T.

Silicates. XI. Further experiments with pyrophyllite and comparison of its reactions with those of talc. E. Thilo and U. Schwarz (*Ber.*, 1941, 74, [B], 196—204; cf. A., 1937, I, 206, 256).—The thermal decomp. of anhyd. pyrophyllite (I), $\text{Al}_2[\text{Si}_4\text{O}_{10}]\text{O}$, which is first detectable at 1150° in the absence of impurities, occurs at 900° in mixtures of (I) with MgO , this being also the decomp. temp. of talc, the Mg analogue of (I). The primary products are Mg spinel and free SiO_2 or Mg_2SiO_4 with some MgSiO_3 , according to the amount of MgO used. Some decomp. of (I) into mullite and SiO_2 also occurs at 1060° (instead of at 1150° in the absence of MgO). CuO reacts with (I) similarly to MgO , transformation into CuAl_2O_4 and SiO_2 being almost complete in 6 hr. at 950°. In presence of MgO or CuO the SiO_2 appears as cristobalite at a temp. much lower than that (1200°) needed when (I) is heated alone. Whereas MgCl_2 reacts with (I) to form a compound analogous to cordierite, CoCl_2 reacts at 800° to give CoAl_2O_4 , SiO_2 , and HCl . In the course of this reaction a bright lavender-blue compound is formed, the nature of which is discussed. A review of the evidence available indicates that the thermal decomp. of (I), like that of talc, consists primarily in the disruption of the tetrahedral, Si-O-Si layers into simple fragments.

F. L. U.

Phosphates. II. Neutral and basic phosphates of alkaline-earth metals. W. Rathje. **III. Hydroxyfluorapatite.** F. Giesecke and W. Rathje. **IV. Neutral and basic phosphates of heavy metals.** **V. Low crystallisation velocity of tertiary phosphates.** W. Rathje (*Ber.*, 1941, 74, [B], 342—349, 349—356, 357—362, 546—552).—II. Phosphates of Mg, Ca, Sr, and Ba are prepared by the method of "acidimetric pptn.," which consists in the slow addition of aq. KH_2PO_4 (or Na_2HPO_4) to a dil. solution of the nitrate or chloride of the metal, a neutral reaction being maintained by the simultaneous addition of aq. NaOH of known concn. From the amount of NaOH used during the pptn. the composition of the ppt. can be calc. To ensure equilibrium and preclude the copptn. of diphosphates the liquid is kept boiling, the solutions are dil., and the precipitant is added slowly. The phosphates stable under these conditions are $\text{Mg}_3(\text{PO}_4)_2$, $3\text{Ca}(\text{PO}_4)_2\cdot\text{Ca}(\text{OH})_2$ (I), $\text{Ba}_3(\text{PO}_4)_2$, and $3\text{Sr}_3(\text{PO}_4)_2\cdot\text{Sr}(\text{OH})_2$.

III. Attempts to prepare fluorapatite by acidimetric pptn. of $\text{Ca}(\text{NO}_3)_2$ by KH_2PO_4 in presence of NaF resulted in the formation of mixtures of $3\text{Ca}_3(\text{PO}_4)_2\cdot\text{CaF}_2$ with (I). Treatment of (I) with conc. aq. NaF leads to decomp. with formation of CaF_2 , but with dil. NaF the liquid becomes alkaline owing to partial exchange between OH and F. No evidence could be obtained for the formation of corresponding compounds having Cl_2 , Br_2 , I_2 , SO_4 or CO_3 in place of F_2 .

IV. Heavy metal phosphates formed by acidimetric pptn. under neutral conditions have the following compositions: $\text{M}_3(\text{PO}_4)_2$ (Cd, Mn, Fe^{II} , Co, Ni, Cu); MPO_4 (Al, La, Ce, Bi); $3\text{M}_3(\text{PO}_4)_2\cdot\text{M}(\text{OH})_2$ (Zn, Pb). FePO_4 free from $\text{Fe}(\text{OH})_3$ can be obtained only in acid solution in presence of excess of PO_4^{3-} .

V. Acidimetric pptns. carried out at 0° often lead to the formation of relatively sol. secondary phosphates, whereas at 100° but otherwise under the same conditions the much less sol. tertiary

phosphates are produced. This behaviour is attributed to the low velocity of crystallisation of the tertiary salts, and is discussed in relation to the softening of hot H_2O , "phosphating" of metals, hardening of Zn phosphate cement, manufacture of superphosphate, and the action of fertilisers. F. L. U.

Hydrides of nickel. R. B. N. Sahai and R. C. Ray (*J. Indian Chem. Soc.*, 1943, 20, 213—217).—An apparatus for preparing large quantities of Ni hydrides from $MgPhBr$, $NiCl_2$, and H_2 is described. The decomp. pressure curve of the hydrides from 30° to 150° consists of two straight lines intersecting at 56°. Below and above 56° NiH_2 and NiH are formed respectively. No other hydride appears to exist within this temp. range. The transition from NiH_2 to NiH is irreversible. The calc. heats of formation, extrapolated to 18° in each case, are NiH_2 35,200, NiH 17,100 g.-cal. C. R. H.

X.—ANALYSIS.

Colorimetric test of pH in alkaline solution by means of permanent colour standard solutions, with special reference to electroplating solutions.—See B., 1943, I, 456.

Salts of trivalent thallium as indicators in alkalimetry and acidimetry. V. K. Zolotuchin (*Zavod. Lab.*, 1940, 9, 133—134).— Tl^{+++} gives in alkaline solutions a yellow sol of $Tl(OH)_3$. The colour change is so abrupt that it can be used in titration, especially in presence of oxidising substances which destroy org. indicators. The solution must contain much Cl^- , so that $NaCl$ is added to H_2SO_4 or HNO_3 before titration. Examples are given for solutions containing Cl_2 , Br , and NO_2 . J. J. B.

Determination of water. E. Eckert and P. Wulff (*Angew. Chem.*, 1940, 53, 403—405).—Modern methods of determining H_2O in org. substances, salts, minerals, etc. are briefly described. A. R. P.

Determination of hygroscopic moisture in crystalline hydrates. A. T. Sveschnikov and N. V. Koleva (*Zavod. Lab.*, 1940, 9, 357).—When hydrates, e.g., $BaCl_2 \cdot 2H_2O$, $CuSO_4 \cdot 5H_2O$, or $KAl(SO_4)_2 \cdot 12H_2O$, are mixed with CaC_2 , the hygroscopic H_2O reacts first and can be calc. from the vol. of C_2H_2 evolved during the first 15 sec. J. J. B.

Rapid determination of water in by-product sulphur.—See B., 1943, I, 445.

Determination of small concentrations of electrolytes by a galvanic method. B. A. Raschkovan (*Zavod. Lab.*, 1940, 9, 728—731).—The solution is placed between a Hg cathode and an anode of amalgamated Cu, and the current in the external circuit measured. The method is applied to the determination of HCl and of $o-C_6H_4(CO)_2O$ in air. J. J. B.

Dynamic determination of free halogens. M. M. Raines, A. I. Krupkin, and P. V. Rodzevitch (*Zavod. Lab.*, 1940, 9, 135—138).—Gas containing Cl_2 or Br (or both) is passed through a 0.15% solution of KI and the colour obtained measured with a photo-cell. If the $[Cl_2]$ or $[Br]$ is <0.1 mg. per l. of air, starch is added to KI. o -Tolidine can be used instead of KI for Cl_2 or Br alone but not for their mixtures. J. J. B.

Determination of halogens. M. B. Schtschigol (*Zavod. Lab.*, 1940, 9, 310—313).—The solution containing Cl^- , Br^- , and I^- is divided into three parts. In (a) all three halogens are exactly pptd. using Q mols. of $AgNO_3$. In (b) I^- is determined by adding $HMnO_4$ and starch and titrating with $AgNO_3$. (c) is mixed with aq. NH_3 (final $[NH_3] = 0.5N$) and with Q mols. of $AgNO_3$; AgI and $AgBr$ are pptd., but $Ag(NH_3)_2Cl$ remains in solution and is determined in the filtrate. J. J. B.

Colorimetric determination of chlorine residuals [in water] up to 30 p.p.m. with o -tolidine.—See B., 1943, III, 283.

Volumetric determination of iodide ion in mercury compounds. V. D. Ponomarev (*Zavod. Lab.*, 1940, 9, 299—300).— HgI_2 or K_2HgI_4 is shaken with Zn amalgam and 2N- H_2SO_4 , and I^- is determined in the resulting solution as usual. J. J. B.

Volumetric determination of iodides [in presence of chloride and bromide.] P. Kainrath (*Z. anal. Chem.*, 1942, 125, 1—5).—The iodide solution, or the Ag halide ppt., is treated with glacial AcOH + 20% NaOAc, and the I^- oxidised to IO_3^- by aq. Br , excess of which is removed by means of 80% HCO_2H (not $PhOH$). 5% KI and dil. H_2SO_4 are added, and the liberated I is titrated by 0.1N- $Na_2S_2O_3$. The I^- content of a photographic film can be similarly determined after removal of AgI from the film by means of 5% $Na_2S_2O_3$. L. S. T.

Colorimetric micro-method for [determination of] dissolved oxygen [in water].—See B., 1943, III, 259.

Electrochemical determination of dissolved oxygen in water.—See B., 1943, I, 426.

Determination by Winkler's method of free oxygen in water containing unsaturated compounds.—See B., 1943, III, 284.

Oxalate method of determining sulphate ion.—See B., 1943, III, 259.

Reaction of selenic acid with silver ion and the consequent separation of selenic from sulphuric acid. R. Ripan (*Z. anal. Chem.*, 1942, 125, 38—40).—4—5 drops of 0.1M- $AgNO_3$ are added to the neutral solution of a selenate or to H_2SeO_4 neutralised to pH 6.7 by $NaHCO_3$. Pptn. of Ag_2SeO_4 can be ensured by adding 2N- $NaOAc$ and $COMe_2$. The limit of identification is 10^{-7} g. For the quant. pptn. and separation of SeO_4^{--} from SO_4^{--} , the solution should be neutral and should contain 2N- $NaOAc$ and 20% of $COMe_2$, and should be $>0.05M$. with respect to SeO_4^{--} . The Ag_2SeO_4 is pptd. by 0.1M- $AgNO_3$ and washed with 20% $COMe_2$. L. S. T.

Determination of selenium in sulphur.—See B., 1943, I, 446.

Detection of nitrates in presence of interfering anions. B. I. Soibelman and F. Bresler (*Zavod. Lab.*, 1940, 9, 359—360).— NO_3^- is detected with $NHPh_2$. To remove the interfering anions the solution is twice evaporated to dryness with 10% aq. NH_3 saturated with SO_2 (thus destroying NO_2^- , MnO_4^- , ClO_3^- , OCl^- , CrO_4^{--} , etc.) and the residue pptd. with cryst. Ag_2SO_4 (eliminating halogens etc.). J. J. B.

Aminosulphonic acid in the determination of nitrites. W. M. Cumming and W. A. Alexander (*Analyst*, 1943, 68, 273—274).— NO_2^- is determined by addition of excess of $NH_2 \cdot SO_3H$ and back-titration with standard $NaNO_2$, using α - $C_{10}H_7 \cdot NH_2$ + p - $NH_2 \cdot C_6H_4 \cdot SO_2 \cdot NH_2$ in AcOH as external indicator. $NaOAc$ is added as a buffer in titrating strongly acid solutions. M. H. M. A.

Determination of nitric oxide in manufactured gases.—See B., 1943, I, 436.

Separation of phosphoric acid as bismuth phosphate in quantitative analysis. I. A. Keschan (Kešans) (*Z. anal. Chem.*, 1942, 125, 6—22).—The pptn. of PO_4^{--} by $BiONO_3$ in dil. HNO_3 , and separation from Li^+ , Na^+ , K^+ , Ca^{++} , Sr^{++} , and Ba^{++} , have been investigated. Data on the solubility of $BiPO_4$ in 0.25—2N- HNO_3 are recorded and discussed; the solubility in 0.5N- HNO_3 is 24.0 mg. per l. Solubility increases in presence of Cl^- , Br^- , I^- , and SO_4^{--} . Pptn. can be made quant. (2 mg. PO_4^{--} per l.) by using excess of precipitant (0.5 g. of $BiONO_3$ in 0.5N- HNO_3). $C_2O_4^{--}$, S^{--} , $S_2O_3^{--}$, CNS^- , IO_3^- , and AsO_4^{--} interfere and must be present only in small amounts. Super-saturation of $BiPO_4$ is marked, but can be overcome by digestion for 6—8 hr. on the water-bath or, preferably, by shaking for 1—2 hr. Small amounts of H_3PO_4 (<0.2 g. per l.) are not pptd., and addition of known amounts of H_3PO_4 or of freshly-pptd. $BiPO_4$ is then necessary. Cations the hydroxides of which are strong bases are generally co-pptd. in small quantities with the $BiPO_4$. Cl^- does not interfere, but SO_4^{--} increases co-pptn. of the alkalis. The order of co-pptn. is $K > Na > Li$, and $Ca > Sr > Ba$. Conditions of pptn. under which contamination of the $BiPO_4$ is negligible are recorded. Excess of Bi in the filtrate from the phosphate pptn. is removed by means of H_2S at room temp., and cations remaining in the filtrate are determined by the usual methods. L. S. T.

Determination of phosphorus in chalk in the form of a complex of phosphoric acid, molybdenum, and 8-hydroxyquinoline.—See B., 1943, I, 444.

Determination of phosphate in plant ash.—See B., 1943, III, 262, 263.

Photometric determination of phosphoric acid in fertilisers.—See B., 1943, III, 263.

Chemical determination of minute amounts of boron in plants.—See B., 1943, III, 263.

Colorimetric determination of boron in steel, using the quinalizarin reaction.—See B., 1943, I, 456.

Detection of silicic acid and hydrofluoric acid by the tetrafluoride and oily drop tests. R. Albrecht and H. Bast [in part with M. Büttner] (*Z. anal. Chem.*, 1943, 125, 321—335).—Success in getting the SiF_4 liberated by heating with H_2SO_4 , to give a white stain on wet, black filter-paper depends on the ratio of $SiO_2 : CaF_2$. Limiting mol. ratios for pptd. SiO_2 are $\sim 1 : 10$, for sea-sand $\sim 1 : 2$, for Na_2SiF_6 $\sim 1 : 6$, for $BaSiF_6$ $1 : <0.17$. By using a drop of H_2O on a rubber rod, transferring to a cellulose acetate slide, adding HCl and $BaCl_2$, and examining microscopically for $BaSiF_6$ crystals, the limiting ratios can be raised, e.g., to $1 : 66$ for pptd. SiO_2 containing 11% of H_2O . For sand and anhyd. pptd. SiO_2 , the only limiting factor for excess of SiO_2 is the min. actual wt. of CaF_2 required (~ 0.2 mg.), but for hydrous SiO_2 there is a limiting ratio ($\sim 25 : 1$). Quartz, however fine, fails to give a positive test. $Na_2B_4O_7$, if >0.2 molar with reference to the CaF_2 , inhibits the reaction. The characteristic oily drops formed when fluorides are heated with H_2SO_4 in glass are inhibited by a $CaF_2 : Na_2B_4O_7$ ratio of $1 : 2$, but the Zr-alizarin lake test is not affected by ratios of even $1 : 25$. S. A. M.

Determination of silicon in steel with a photocolormeter.—See B., 1943, I, 456.

Gravimetric determination of potassium, rubidium, and caesium. O. G. Scheintzis (*Zavod. Lab.*, 1940, 9, 162—163).—0.2—0.005 g. of K, Rb, or Cs is pptd. by 3% Mg salt of dipicrylamine, the ppt. is washed with H₂O-free Et₂O at 10°, dried at 80—90°, and weighed.

J. J. B.

Sedimentary determination of potassium and its use in soil investigations.—See B., 1943, III, 230.

Determination of sodium in presence of molybdenum. C. H. Hale (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 516—517).—Mo interferes by forming a ppt., presumably of UO₂MoO₄, with the Zn UO₂ acetate reagent. The interference is overcome by adding citric or tartaric acid to form the sol. complex with MoO₄". Details of procedure and test data are given.

L. S. T.

Rapid determination of sodium chloride in presence of protein.—See B., 1943, III, 250.

Sensitivity of chemical reactions. VI. Reactions giving rise to supersaturated solutions. Z. Karaoglanov (*Z. anal. Chem.*, 1943, 125, 336—349; cf. A., 1943, I, 163).—The sensitivity of the reaction $\text{Ca}^{++} + \text{SO}_4^{--}$ is raised by increasing the reaction time or the concn. of reagent, or (for shorter reaction times) by seeding with CaSO₄·2H₂O or BaSO₄, or scratching with a glass rod, or by starting the reaction by warming for 5 min.; it is markedly lowered by the presence of HCl. CaSO₄ forms supersaturated solutions, which, however, are much less stable than those of Mg₂C₂O₄. In the separation of Ba from Ca by the SO₄" method, pptn. is carried out slowly, at room temp., and in presence of HCl. The reaction $\text{Sr}^{++} + \text{CrO}_4^{--}$ is much less affected by the above factors, except that there is a marked decrease in sensitivity in presence of AcOH. SrCrO₄ forms only unstable supersaturated solutions. $\text{Ba}^{++} + \text{CrO}_4^{--}$ is a highly sensitive reaction, not greatly affected by factors other than the concn. of reagent and the presence of AcOH; BaCrO₄ does not form supersaturated solutions. To separate Ba from Sr by the CrO₄" method, pptn. is carried out with a slight excess of pptg. agent at room temp. in presence of dil. AcOH, the ppt. being filtered off at once. The reaction $\text{Hg}^{++} + \text{CNS}'$ is much more sensitive when the reagents are in equiv. proportions than under the usual conditions, owing to the solubility of Hg(CNS)₂ in either Hg(NO₃)₂ or NH₄CNS; seeding, scratching, and longer reaction times increase the sensitivity.

S. A. M.

Determination of active calcium oxide in quicklime.—See B., 1943, I, 444.

Rapid analysis of technical magnesium chloride.—See B., 1943, I, 444.

Determination of traces of zinc with Pulfrich's photometer. L. Kulberg and F. Jurovskaja (*Zavod. Lab.*, 1940, 9, 295—296).—A solution containing 10⁻³—10⁻⁶ g. of Zn, and similar amounts of Fe, Al, Mn, Cu, Ca, and Mg, is mixed with 0.5 ml. of 10% KI and completely evaporated. The solid is dissolved in 2 ml. of H₂O; Cu remains in the residue. To the liquid NH₄ citrate and HCO₂H are added, and ZnS is pptd. with H₂S. ZnS is transformed into Zn salt of 8-hydroxyquinoline, which is decomposed with HCl, and 8-hydroxyquinoline is coupled with diazotised sulphanilic acid. The NH₄ salt of the dye obtained has an absorption max. near 470 mμ. Its amount is determined with a photocolormeter, using a green filter.

J. J. B.

Determination of small amounts of cadmium in air.—See B., 1943, III, 257.

Separation of lead from copper, cadmium, and iron, as lead chromate. I. Sarudi (v. Stetina) (*Z. anal. Chem.*, 1943, 125, 370—372).—1% K₂CrO₄ is added dropwise to a boiling solution of the nitrates or acetates (not chlorides) in very dil. HNO₃, to which NaOAc and AcOH have been added, and the pptd. PbCrO₄ washed with 1% AcOH, EtOH and Et₂O, and dried at 100°. The Cu is determined electrolytically after reduction of excess of CrO₄" with CH₃O, or is pptd. as CuS and Cu₂S by Na₂S₂O₃ and ignited to CuO. The Cd is pptd. as CdS and determined as such or as CdNH₄PO₄·H₂O or Cd₂P₂O₇. The method is quicker and simpler than the SO₄" method, and satisfactory results are obtained.

S. A. M.

Determination of lead in air by means of dithizone.—See B., 1943, III, 257.

Volumetric determination of lead.—See B., 1943, III, 277.

Work involved in and efficiency of colorimetric methods. A. Schleicher (*Z. anal. Chem.*, 1943, 125, 385—405).—The energy requirements and the rate of performance of colorimetric methods are discussed in relation to the determination of Cu⁺⁺ colorimetrically by the following methods, for which data obtained with the Lange photo-electric colorimeter are recorded: NH₃, sulphide, benzidine, ferrocyanide, dithizone, salicylic acid, iodide, and diethyldithiocarbamate methods.

L. S. T.

Detection of copper ion. N. A. Tananaev and V. N. Podtschainova (*Zavod. Lab.*, 1940, 9, 168—169).—0.5 mg. of Cu in 1 l. is detected by introduction of CdS into the solution; if [Cu] is not too low, the CdS becomes dark, otherwise it is dissolved in dil. HCl and CuS observed in the residue. If the solution contains Bi, Ag, or Hg in addition to Cu, the ppt. of the sulphides is dissolved in aqua regia and the solution treated with conc. NH₃; 10 mg. of Cu per l. give a blue colour.

J. J. B.

Application of compensation in polarographic determination of copper in zinc sulphide.—See B., 1943, I, 444.

Volumetric thiocyanate process for determining mercury. Z. Karaoglanov (*Z. anal. Chem.*, 1943, 125, 406—416).—Data showing the effect of varying conditions on the titration of Hg⁺⁺ by CNS' are recorded and discussed. The method is trustworthy when the titration is made at room temp. in presence of sufficient HNO₃ and indicator solution. Fe(NO₃)₃ or Fe alum can be used as indicator, the Hg salt can be either nitrate or sulphate, and Hg⁺⁺ can be titrated by CNS', or CNS' by Hg⁺⁺. Deviations occur when titration is effected in hot solution, or when [HNO₃] is too low, or the solution is too dil. with respect to Hg⁺⁺. In presence of PO₄"', extra indicator and HNO₃ are needed. Cl' and Br' must be absent. Hg dissolved in HNO₃, with subsequent removal of oxides of N, is the best substance for standardisation of the NH₄CNS. AgNO₃ can be used as reference substance, but the titration by CNS' must then be carried to the second, permanent red coloration.

L. S. T.

X-Ray analysis of the rare elements of the cerium group. I. B. Borovski, M. A. Blochin, and L. A. Grschibovskaja (*Zavod. Lab.*, 1940, 9, 740—741).—When the relation between the amount of an element and the intensity of its X-ray lines is found by experiment, unknown concns. of this element can be found from X-ray spectra. The method is applied to minerals containing Ce, La, Nd, Pr, and Sm; the error usually is <7%.

J. J. B.

Direct volumetric and gravimetric determinations of cerium and thorium by the iodate method. J. A. Tschernichov and T. A. Uspenskaja (*Zavod. Lab.*, 1940, 9, 276—283).—The ppt. obtained from Ce(NO₃)₃ and a large excess of 10% KIO₃ + 2.5% HNO₃, after being washed with 95% EtOH and Et₂O, is 2Ce(IO₃)₄·KIO₃·8H₂O (I). It can be weighed directly or titrated with KI; one Ce liberates 28 equivs. of I. An analogous ppt. from Th(NO₃)₄ is 4Th(IO₃)₄·KIO₃·18H₂O (II). It liberates 25.5 equivs. of I per one Th. If the solution contains both Th and Ce, Ce⁺⁺⁺ is reduced to Ce⁺⁺⁺ by H₂O₂, (II) is pptd., and Ce⁺⁺⁺ in the filtrate is treated with KBrO₃, when (I) is formed.

J. J. B.

Determination of traces of aluminium with aluminon. L. M. Kulberg and E. I. Rovinskaja (*Zavod. Lab.*, 1940, 9, 145—148).—10⁻⁶—10⁻⁵ g. of Al can be determined in presence of <4 mg. of Ca, <0.5 mg. of Mg, <2 × 10⁻⁵ g. of Cu, Mn, and Zn, and <3 mg. of PO₄"', if the solution contains also 0.5—2 mg. of Fe⁺⁺⁺. Al + Fe are pptd. with 8-hydroxyquinoline in dil. AcOH at 50°, and the ppt. is transformed into chlorides and extracted with 50% KCNS and Et₂O. The residue is transformed into Al aurintricarboxylate and the colour intensity measured with a photo-cell using a green filter since the absorption max. of the salt is at 530 mμ.

J. J. B.

Determination of aluminium oxide in aluminium.—See B., 1943, I, 458.

Improved manganese separation for the phosphate method and for general use. G. J. Austin (*Analyst*, 1943, 68, 274—275).—The solution left after removal of Ni, Co, and Zn with (NH₄)₂S, containing Mn, Ca, and Mg, is buffered to pH 4.4—4.8 with AcOH-NH₄OAc and Mn is pptd. as MnO₂ by adding a slight excess of NaIO₄ and a little HCO₂H to inhibit further oxidation. The ppt. is freed from traces of Ca and Mg with hot 0.1N-HNO₃. Excess of P₂O₅ causes the MnO₂ to be slightly sol. in hot 0.1N-HNO₃, and the original solution must be diluted to >0.1% P₂O₅ before oxidation.

M. H. M. A.

Separation of the metals of the third group from calcium, magnesium, and alkalis by means of hydrogen sulphide in presence of hexamethylenetetramine. E. A. Ostroumov and R. I. Bomshtein (*Zavod. Lab.*, 1940, 9, 139—142).—If Mn⁺⁺, Fe⁺⁺⁺, Al⁺⁺⁺, Cr⁺⁺⁺, and Zn⁺⁺ are pptd. by H₂S in presence of (CH₂)₆N₄ at 60—99°, the pH of the solution increases gradually and every sulphide is pptd. more or less separately, forming crystals which do not adsorb Ca, Mg, or alkali metals. To a solution containing 0.3 g. of the metals 20—25 g. of NH₄Cl are added; after heating to 60° 7 g. of (CH₂)₆N₄ are added and H₂S is passed through at a slowly rising temp. for ~1 hr. If Ni⁺⁺ or Co⁺⁺ is also present, a little C₆H₅N₃HCl is added before the (CH₂)₆N₄.

J. J. B.

Application of the photocolormeter in volumetric analysis. J. J. Lurie and E. M. Tal (*Zavod. Lab.*, 1940, 9, 702—714).—In the simplest cases the light absorption of the solution is measured at three additions of standard solution, one being before and two after the end-point has been reached; the end-point is the crossing of the straight lines drawn through the zero point and the first measured

point, and through the two other measured points. This method is used for permanganometry (determination of Fe in presence of coloured cations, e.g., Ni and Co) and alkalimetry in presence of phenolphthalein. A suitable light filter facilitates the titration. In more complicated cases, when the solution is coloured throughout (titration with Me-orange, Me-red, etc.), the light absorption must be measured for many additions, and the end-point found graphically. The method is indicated for coloured solutions, e.g., for determining the acidity of technical Ni and Co sulphates and of Ni and Co electroplating baths. J. J. B.

Determination of small amounts of trivalent chromium in chromic acid. V. E. Kuteinikov (*Zavod. Lab.*, 1940, 9, 305—306).—Cr⁺⁺⁺ is separated from a large excess of CrO₄^{''} or Cr₂O₇^{''} by pptg. with Na₂HPO₄ in an acid solution; Cr phosphate is oxidised with (NH₄)₂S₂O₈ to CrO₄^{''}, which is titrated. J. J. B.

Determination of chromium in steel, alloys, and chromite.—See B., 1943, I, 456.

Determination of molybdenum by internal electrolysis. J. A. Tschernichov and E. V. Schtutzer (*Zavod. Lab.*, 1940, 9, 723—728).—Mo is electrodeposited from a solution containing AcOH 0.3, NH₄OAc 0.17, and NH₄Cl 1%, at 70—75°, as a compound Mo₂IVO₄·5H₂O. It can be weighed as such. If Fe⁺⁺⁺ is present, it is reduced to Fe⁺⁺ by NH₂OH, and Mo is deposited as before. Large amounts of salts like NaCl, Na₂SO₄, etc. increase the wt. of the electrodeposit. If VO₃['] is present, it must first be removed by NH₃. The method is used for the analysis of wulfenite. J. J. B.

Use of pyridine in determination of uranium and its separation from the alkaline-earth metals. L. E. Kaufman (*Zavod. Lab.*, 1940, 9, 228—229).—U is pptd. by C₅H₅N only if the [(NH₄)₂CO₃] is low. If the solution contains U, Fe, and alkaline earths, U and Fe are pptd. by C₅H₅N, U is extracted from the ppt. by conc. (NH₄)₂CO₃, and Fe determined in the residue. Th is pptd. by C₅H₅N like U, but the pptn. of Ce is slow. J. J. B.

Effect of germanium on iodometric determination of tin. I. P. Alimarin and B. N. Ivanov-Emin (*Zavod. Lab.*, 1940, 9, 356).—Ge does not interfere with the titration of Sn⁺⁺ so long as its concn. is <0.1%. J. J. B.

Gravimetric determination of tin in steel (other than chrome steel).—See B., 1943, I, 456.

p-Hydroxyphenylarsonic acid as selective precipitant for titanium in the analysis of titanium ores.—See B., 1943, I, 457.

Rapid determination of zirconium. T. A. Uspenskaja, E. I. Guldina, and M. S. Zverkova (*Zavod. Lab.*, 1940, 9, 142—145).—A solution of 0.2 g. of Zr in 5% HCl is mixed with 1.5 ml. of 0.03% alizarin (I) and with enough 0.1N-NaF to produce a yellowish-pink colour. To another solution containing the same amounts of HCl, (I), and NaF a titrated solution of ZrOCl₂ is added to give the same colour. Fe⁺⁺⁺ and SO₄^{''}, but not Fe⁺⁺, interfere. J. J. B.

Spectrochemical analysis of solutions and minerals. VIII. Direct determination of germanium in coal ash.—See B., 1943, I, 436.

Polarographic studies. III. **Determination of vanadium.** J. E. Page and F. A. Robinson (*Analyst*, 1943, 68, 269—271).—Org. V compounds are heated with conc. H₂SO₄ + HNO₃ or fused with Na₂CO₃ + KNO₃ to form VO₄^{'''}, which is determined polarographically in presence of conc. aq. NH₃. $i_d \propto [V]$ in the range 5×10^{-3} — 5×10^{-4} M. Vals. obtained agree to $\pm 4\%$ with vals. obtained volumetrically. M. H. M. A.

Simplified cell unit for internal electrolysis. [Determination of bismuth in lead.]—See B., 1943, I, 457.

Spectral analysis of small amounts of iridium and rhodium in platinum preparations. A. V. Babaeva, V. I. Belova, and S. A. Borovik (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 101—103).—Ir and Rh are determined in Pt compounds by their spark spectra, ~3 mg. of material being fixed in a hollow in the lower C electrode with collodion. The method is sensitive to 0.001% with an accuracy of $\pm 4.5\%$. M. H. M. A.

XI.—APPARATUS ETC.

Vacuum furnace. W. Ehrenberg and F. Ansbacher (*J. Sci. Instr.*, 1943, 20, 164—165).—The apparatus eliminates the disadvantages of external heating by the use of an internal heater of Ni (Ta or Mo) strips wound on ceramic rods and surrounded by a Cu reflecting screen. Performance data are given. N. M. B.

Electric furnace for intensive heating of crucibles. K. A. Karajanopulo (*Zavod. Lab.*, 1940, 9, 366).—The heating elements are CSi rods. The furnace can be used up to 1520°. J. J. B.

Thermostat keeping an exactly controlled temperature. K. P. Florenski (*Zavod. Lab.*, 1940, 9, 189—191).—A Hg thermometer immersed in the thermostat is placed between a source of light and a

photo-cell so that the top of the Hg column casts a shadow on the cell when the temp. is too high; when the photocurrent ceases, the heating is switched off. When the stirring is intensive enough, the temp. can be kept for several hr. within 0.001°. J. J. B.

Water thermoregulator. W. E. Boyd (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 523).—The portable apparatus described maintains a variation of $\pm 0.5^\circ$. L. S. T.

Compensated hot-wire air thermometer. M. A. El-Sherbini and Y. L. Yousef (*Proc. Physical Soc.*, 1943, 55, 427—428).—A simple instrument for measuring currents at frequencies up to radio-frequency is constructed from a thermally screened Roberts-type micromanometer, with a hot wire in each limb. Paraffin oil manometric liquid encloses a bubble in the capillary. Performance, sensitivity, and calibration are outlined. N. M. B.

Temperature determination with a photocell. A. A. Novikov (*Zavod. Lab.*, 1940, 9, 750—754).—The ratio of the red to the blue radiation of a heated body is determined using a red and a blue filter and Sb-Cs photocells. The temp. is calc. from this ratio for 15 incandescence lamps. J. J. B.

Practical colour measurement. S. Rösch (*Z. Elektrochem.*, 1941, 47, 18—19).—The introduction of suitable colour standards and new and improved instruments for the determination of colour have made it possible to some extent to interpret data obtained in colour measurements on one system with respect to those obtained on another. A. J. M.

Visual photometry in the region of low brightnesses. A. Gerschun (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 125—126).—Accuracy of photometric measurements is greatest when the light from the field of comparison has a definite spectral composition, the measured brightness is not weakened, the angle subtended by the field of vision is $\sim > 6^\circ$, and the exit pupil of the apparatus is $>$ that of the pupil of the eye by ~ 7 mm. L. S. T.

Photo-electric photometer. P. W. Cunliffe (*J. Text. Inst.*, 1943, 34, 155—60).—The photometer described is constructed from a vac. emission photo-cell and the valve potentiometer part of a glass-electrode pH-meter. Its use is exemplified by absorption of dyes from their solutions, chemical analysis by colorimetric methods, and spectrophotometry. F. O. H.

Surface replicas containing dye for use in the light microscope. V. J. Schaefer (*Met. Progr.*, 1943, 44, 72—74).—A solution of dye in resin is placed over the micrographic specimen, and when dry the replica is removed and examined under the microscope. Variations in colour density on the photomicrograph are directly related to variations in depth on the original surface of the specimen. R. B. C.

Manipulation of the microscope. Observations on technique. I—III. F. D. Armitage (*Ind. Chem.*, 1943, 19, 447—454, 495—500, 549—554).—The general use of the microscope, the measurement of area, the interpretation of images and possible sources of error, and the choice of a technical microscope are described and illustrated. L. S. T.

Recording microphotometer for the examination of X-ray diffraction films. H. R. Ronnebeck (*J. Sci. Instr.*, 1943, 20, 154—161).—The mechanical features (lathe bed, roller gears, half-speed drive, etc.) are described. The recording system is a photocell-photometer unit with an amplifier and Einthoven string galvanometer. The performance is discussed and a full bibliography given. N. M. B.

Determination of the integral energies of X-ray lines in structure analysis. III. **Rapid method of integral photometry of diffraction spots.** V. P. Kotov and A. C. Breger (*J. Phys. Chem. Russ.*, 1943, 17, 51—56).—A wide photometer slit is used allowing the photometry of a whole spot at once. The val. obtained is corr. using an empirical relation between the total absorption on the one hand and the ratio (area of spot) : (area of slit) and the average blackness of the spot on the other. J. J. B.

X-Ray methods of determining size and shape of submicroscopic crystals. G. S. Shdanov (*Zavod. Lab.*, 1940, 9, 732—740).—A review. J. J. B.

Apparatus for making X-ray powder photographs at controlled, elevated temperatures. M. J. Buerger, N. W. Buerger, and F. G. Chesley (*Amer. Min.*, 1943, 28, 285—302).—Complete details (A., 1943, I, 210) are given. L. S. T.

Million-volt portable radiographic X-ray unit. E. E. Charlton and W. F. Westendorp (*Proc. Amer. Soc. Test. Mat.*, 1942, 42, 1088—1098). R. B. C.

Exposure meter for X-ray radiography. H. Friedman and A. L. Christenson (*Proc. Amer. Soc. Test. Mat.*, 1942, 42, 1145—1153). R. B. C.

Universal source of excitation of spectra. N. S. Sventitzki (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 205—208).—An a.c. arc, which can produce both arc and spark spectra by variation of the capacity and inductance of a steadying superimposed high-frequency discharge, is described. W. R. A.

Method of feeding in spectrochemical analysis. S. I. Safonov (*Zavod. Lab.*, 1940, 9, 187—188).—Spectra are produced in a vertical C arc. The powder to be analysed is fed into the flame through a channel along the axis of the upper electrode; it is gradually shaken into this channel by the hammer of an electric bell. If the powder sinters within the electrode, sparks must be used instead of arc.

J. J. B.

Spectrophotometric method for the analysis of multi-component mixtures and its infra-red application. R. R. Brattain, R. S. Rasmussen, and A. M. Cravath (*J. Appl. Physics*, 1943, 14, 418—428).—The method is based on the assumption that the optical density of a mixture is an additive property, although the transmissions of the separate components may not follow Beer's law. The application of the method to infra-red absorption of vapour samples is described in detail, and the results of tests using a 6-component C_4 hydrocarbon mixture are given. The method is particularly suited to the rapid routine analysis of large nos. of liquid or vapour samples containing the same components. It is the only practical method of analysis of mixtures such as the isomerides of Δ^8 -butene.

L. S. T.

Apparatus for studying transformations in alloys by means of electric resistance. M. E. Blanter (*Zavod. Lab.*, 1940, 9, 332—335).—An apparatus which continuously records the temp. of the specimen, the potential drop in it, and the current strength is described. The temp. of transformations can be measured within $\pm 2\%$.

J. J. B.

Silver chloride electrode. O. Redlich and L. F. Maranville (*J. Chem. Educ.*, 1943, 20, 10).—Advantages of the AgCl electrode (prep. described) over the calomel electrode are emphasised.

L. S. T.

Vacuum-tube voltmeter for measuring high negative potentials. M. Kupferberg (*Rev. Sci. Instr.*, 1943, 14, 254).—A circuit capable of measuring negative voltages from 0 to 5000 v. with a max. error of 2% is presented. The meter has a zero adjustment and two voltage ranges, 0—3000 v. and 0—5000 v.

J. L. E.

Theoretical problems in the practical polarographic work. T. A. Kriukova (*Zavod. Lab.*, 1940, 9, 691—698).—Some difficulties of polarography are reviewed, including the polarographic max., its dependence on the movement near the cathode and on the concn. of the supporting electrolyte, the extinguishing of the max. and the secondary effects of the extinguishing substances, the influence of the concn. of the supporting electrolyte on the position and shape of polarographic waves, polarographic waves of ions reducible in steps, and also substitution of solid cathodes for Hg drops.

J. J. B.

Apparatus for micro-determination of magnetic susceptibility. H. Theorell (*Arkiv Kemi, Min., Geol.*, 1943, 16, A, No. 1, 8 pp.).—A micro-modification of the Gouy method is described. A thin tube divided centrally into two sections, one of which contains the solution under test, is suspended horizontally in a magnetic field by two long fibres. The horizontal displacement on application of the field is observed with a microscope, oscillations being damped by a rod attached to the tube and dipping into glycerol. The second section of the tube may be filled with aq. NaCl or FeCl₃ to correct any displacement due to the tube itself.

A. J. E. W.

Cooling hydrogen discharge tubes. Chao-wang Hsueh (*Rev. Sci. Instr.*, 1943, 14, 250—253).—A method for cooling H₂ discharge tubes to 56° K. by means of rapidly evaporating liquid air under reduced pressure is described. The temp. is measured with a Cu-constantan thermocouple.

J. L. E.

Electron reflecting microscope; a new ultra-microscope. H. Mahl and A. Pendzich (*Z. tech. Physik*, 1943, 24, 38—42).—Details are given of an electron microscope having an electron mirror as projective. By reversal of the electron beam a "stage-microscope" which is very compact can be obtained.

J. F. H.

Technique of neutron probes. W. Bothe (*Z. Physik*, 1943, 120, 437—449).—Errors involved in measurements of neutron density by probes are analysed and conditions for accurate measurement of neutron streams are discussed.

L. J. J.

Apparatus used in radium radiography. L. W. Ball and D. R. Draper (*Proc. Amer. Soc. Test. Mat.*, 1942, 42, 1134—1143).—

R. B. C.

Weighing method of sedimentometric analysis. S. J. Starodubtzev (*Zavod. Lab.*, 1940, 9, 758—760).—A simplified Odén balance allows measurement of time of sedimentation of every 0.1 mg. (or of every 5 mg.) of suspension.

J. J. B.

Apparatus for semi-micro-evaporations. S. Gaddis (*J. Chem. Educ.*, 1943, 20, 28).—Kurtz' method (A., 1942, I, 281) is modified.

L. S. T.

Testing of measuring flasks. L. A. Mindalev (*Zavod. Lab.*, 1940, 9, 365).—A known amount of solid is dissolved in the contents of the flask, and its amount in 50 ml. or 100 ml. taken from the flask is determined.

J. J. B.

Analytical washing bottle. V. A. Alexandrov (*Zavod. Lab.*, 1940, 9, 245).—A Bunsen valve is attached to the injector tube for use with unpleasant liquids.

J. J. B.

Apparatus for filtering in a stream of inert gas. N. I. Stognii (*Zavod. Lab.*, 1940, 9, 236—237).—An apparatus is described made up of a separating funnel, two filtering funnels, and an aspirator.

J. J. B.

Convenient arrangement for rapid dialysis. W. H. Seegers (*J. Lab. clin. Med.*, 1943, 28, 897—898).

C. J. C. B.

Dispenser for corrosive liquids. S. Zuffanti (*J. Chem. Educ.*, 1943, 20, 28).—An arrangement for aspirating definite vols. of liquid, particularly Br, into a graduated cylinder is described.

L. S. T.

Laboratory stirrer. V. M. Muchatshev (*Zavod. Lab.*, 1940, 9, 244—245).—The reaction vessel is rotated along a conical surface.

J. J. B.

Mol. wts. of high polymers. M. L. Huggins (*Ind. Eng. Chem.*, 1943, 35, 980—986).—Methods for determining the above are subjected to crit. mathematical consideration. The osmotic or cryoscopic data yield ordinary "no.-average" mol. wts., whereas η data, if properly interpreted, yield " η average" results in which the heavier mols. are relatively more important. For characterisation of a polymer it is desirable to know the dependence of the osmotic pressure and η on concn. and that of the intrinsic η on mol. wt., whereby, from a single measurement of η and of osmotic pressure, it is possible to calculate the two distinct mol. wt. vals.

D. F. T.

Purification of substances by partial fusion and warm absorption. J. Lindner (*Ber.*, 1941, 74, [B], 231—237).—Mixtures of substances are warmed to suitable temp. < that of complete fusion and the liquid portion is absorbed by porous material, such as porous plate or filter-paper. Limitations of the method are recognised and an illustrative example is the mixture of Ph₂ and NHPPh₂, which gives a simple m.p. diagram with a eutectic point at 29.5°. The method is applicable to small amounts.

J. W. A.

Determination of densities of reactive gases. H. von Wartenberg (*Z. Elektrochem.*, 1941, 47, 92—94).—A column of the reactive gas is balanced in a xylene (I) manometer against a column of air. A buffer space containing air prevents the reactive gas from coming in contact with the (I). The pressure difference is read by means of a microscope, and gives d to 1%. The construction and calibration of the apparatus are described.

A. J. M.

McLeod gauge of great accuracy and sensitivity. G. Haase (*Z. tech. Physik*, 1943, 24, 27—34).—Inaccuracies, present in the usual instruments with very narrow capillaries, caused by irregular motion of the Hg, are eliminated by weak etching of the capillary with aq. or gaseous HF, without impairing the visibility of the walls. Contact of the Hg with air or O₂ must be avoided. Before each determination, all parts of the gauge, except the Hg reservoir, are heated to the softening point of the glass. By these means the McLeod gauge can be used down to pressures of $\sim 4 \times 10^{-7}$ mm. Hg.

J. F. H.

Method for determining the coefficients of friction μ_0 and μ . B. Piesker (*Z. tech. Physik*, 1943, 24, 34—38).—The apparatus used consists of the usual inclined plane with the addition of an electromagnetic system above the sliding body. The inclined plane is set an angle α ($< \rho$) and the field strength increased until sliding occurs. The process is then repeated with an additional wt. on the pan. The measurements made permit the calculation of μ_0 . The determination of μ is carried out similarly from the increase of kinetic energy in the magnetic field ($\alpha > \rho$). By the use of a.c., an imitation of actual machine conditions can be obtained.

J. F. H.

Berthelot method of measuring tension in liquids. R. S. Vincent and G. H. Simmonds (*Proc. Physical Soc.*, 1943, 55, 376—382; cf. A., 1943, I, 72).—A modified method in which the pressure at the moment of sealing is known gives vals. > 25 atm. compared with ~ 150 atm., which are considered likely to be falsely high, by the normal method. The order of magnitude agrees with the vals. obtained by the viscosity tonometer method.

N. M. B.

Cellulose acetate capillaries for Debye-Scherrer photographs. R. Fricke, O. Lohrmann, and W. Schröder (*Z. Elektrochem.*, 1941, 47, 374—379).—A method of forming cellulose acetate capillaries of definite dimensions by moulding on Cu wires, and the accurate determination of their diameters, are described. The capillaries are suitable for the study of powders by the Debye-Scherrer method, since the "amorphous ring" due to the cellulose acetate is smaller than that due to glass.

J. W. S.

Use of Wood's metal in vacuum systems. A. L. Hughes and C. S. Pao (*Rev. Sci. Instr.*, 1943, 14, 254—255).—The use of Wood's metal as a substitute for the usual greases in the lubrication of standard taper joints and in a device for the replacement of stopcocks is described.

J. L. E.

Equivalent penetrometers in radiographic testing. R. J. Schier and G. E. Doan (*Proc. Amer. Soc. Test. Mat.*, 1942, 42, 1166—1168).

R. B. C.

Laboratory penetrometer. N. D. Talanov (*Zavod. Lab.*, 1940, 9, 794—795).—A penetrometer made from a hand balance is described. It is used for testing C electrodes.

J. J. B.

Improved Kipp apparatus. G. N. Evetzki and I. L. Degtiarev (*Zavod. Lab.*, 1940, 9, 364—365).—The vol. of gas produced is measured in a burette attached to the Kipp apparatus. J. J. B.

Air-free carbon dioxide from a Kipp apparatus for the Dumas nitrogen determination. H. Brintzinger (*Z. anal. Chem.*, 1942, 125, 5—6).—Before the marble is placed in the Kipp apparatus, air trapped in the capillary spaces of the marble lumps is removed by covering the lumps with H_2O or aq. $CaCl_2$ in a well-closed flask which is attached to a H_2O -pump for several hr. L. S. T.

Gas-absorption apparatus. L. Bolstad and R. E. Dunbar (*Ind. Eng. Chem. [Anal.]*, 1943, 15, 498).—The apparatus described fits into a filter-flask and ensures prolonged and intimate contact of gas and liquid. It has been used successfully in the prep. of org. acetates. L. S. T.

Determination of volumes by the use of carbon dioxide. W. W. Barkas and J. M. Paton (*J. Sci. Instr.*, 1943, 20, 163—164).—A method is given, with illustrative data, for calibrating an unknown irregular vol. by filling with CO_2 to a known pressure and determining the wt. of the CO_2 after absorption in soda-asbestos. N. M. B.

Simple volumometer. L. A. Gontscharski (*Zavod. Lab.*, 1940, 9, 795—796).—A vessel is rigidly connected to a glass capillary in which a short column of paraffin oil can move. When the vessel is tilted so that the capillary points downwards, the oil descends until the pressure in the vessel reaches a definite min. val. When the vol. of air in the vessel is reduced by placing a solid in it, the oil descends less; this permits the vol. of the solid to be calc. J. J. B.

Dilatometers for thermal analysis of metals.—See B., 1943, I, 458.

Absolute method for determining the area of a fine crystalline powder. Adsorption method for determining the area of a solid without the assumption of a mol. area.—See A., 1943, I, 303.

Method of sealing fused silica tubes. W. McCavock (*J. Chem. Educ.*, 1943, 20, 20).—Technique for joining or welding sand surface fused SiO_2 tubing >3 in. in diameter is described and illustrated. L. S. T.

Recent developments in hygrometry. J. H. Awbery (*J. Sci. Instr.*, 1943, 20, 153—154).—A brief summary of improved technique and refinements with the gravimetric, dew-point, and wet-and-dry-bulb methods, and hair, Cellophane, glycerol, and electrical resistance hygrometers. N. M. B.

Condensers with intensive cooling. K. A. Bogdanov (*Zavod. Lab.*, 1940, 9, 237).—A distillation column like that of Lebel and Henninger is surrounded by a H_2O -jacket. J. J. B.

XII.—LECTURE EXPERIMENTS AND HISTORICAL.

Photochemical reaction of hydrogen and chlorine. Lecture demonstration. C. M. Furgason and J. W. Moore (*J. Chem. Educ.*, 1943, 20, 41—42). L. S. T.

Lecture demonstration of mixture versus compound. A. Scattergood (*J. Chem. Educ.*, 1943, 20, 40).—The formation of SbI_3 by heating Sb with I dissolved in an org. solvent such as C_2Cl_4 or CCl_4 is utilised. L. S. T.

Nicholas Leblanc, 1742—1806. R. E. Oesper (*J. Chem. Educ.*, 1943, 20, 11—20). L. S. T.

Chemistry of the solid state. R. Schenck (*Z. Elektrochem.*, 1941, 47, 1—8).—An historical review, dealing chiefly with the work of the author. A. J. M.

XIII.—GEOCHEMISTRY.

Hydrochemical facies of the fluvial waters and their zoning. G. A. Maximovitsch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 185—190).—Hydrochemical facies, i.e., the portions of a river bed characterised by the predominance in its H_2O of a dissolved substance or group of substances, are tabulated from data showing the mineralisation of numerous rivers of the world. L. S. T.

Origin and geochemistry of connate waters in West Virginia. E. T. Heck, C. E. Hare, and H. A. Hoskins (*Bull. Geol. Soc. Amer.*, 1940, 51, 1995).—Plotting % of Na against total solids shows that there has been a relative loss of Na in brines that contain $>140,000$ p.p.m. of total solids. This loss is probably caused by fractional pptn. of halite. The chemical composition of the Carboniferous sea was probably similar to that of present-day sea- H_2O . L. S. T.

Ground water and hydrothermal deposits. C. H. Behre, jun., and R. M. Garrels (*Econ. Geol.*, 1943, 38, 65—69).—Evidence for the hypothesis that deposits are localised to near-surface positions by reaction between mineralising rising solutions and cool, neutralising ground H_2O is advanced. L. S. T.

Time relations in ocean sediments. C. S. Piggot and W. D. Urry (*Bull. Geol. Soc. Amer.*, 1942, 53, 1187—1210).—Time-intervals in

ocean-bottom cores, and the rate of deposition of ocean sediments are discussed. L. S. T.

Source of beach and river sands on gulf coast of Texas. F. M. Bullard (*Bull. Geol. Soc. Amer.*, 1942, 53, 1021—1043).—Heavy mineral analyses are recorded and discussed. The origin of the sands is also discussed. L. S. T.

Black beach sands of Guatemala, Central America. M. F. Boos (*Bull. Geol. Soc. Amer.*, 1940, 51, 1921).—66% of the sand is magnetite (I), the amount of which decreases markedly close to mouths of streams. Chemical analysis shows traces of W and Ti and 20—30% of SiO_2 . Rare yellow topaz, quartz, sphene, and andesite occur with (I). L. S. T.

Boron distribution in recent organogenic deposits. L. A. Guliaeva (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 28—31).—Highly org. fresh H_2O deposits (sapropels) do not show appreciable B enrichment in comparison with average B content of soils and earth crust; similar deposits from saline waters, containing fatty algæ (balkhasite), are relatively rich in B. L. J. J.

Organic content of cores from Gulf of Mexico off Mississippi delta. H. J. Bissell (*Bull. Geol. Soc. Amer.*, 1940, 51, 1920).— >200 samples from 24 cores have been analysed. Excluding a few thin beds of coarse silt and sand, the samples show a min. of 2% of org. matter, with many beds containing $>4\%$. The darker-coloured near-shore samples have only a slightly higher org. content than the light-coloured deep- H_2O sediments. Deep- H_2O cores show a slight decrease in org. content with depth; all cores show a decrease in N with depth, the C : N ratio increasing towards the bottom of the core. L. S. T.

Structural history of iron meteorites. J. O. Lord (*Bull. Geol. Soc. Amer.*, 1940, 51, 2040). L. S. T.

Meteorites and an earth-model. R. A. Daly (*Bull. Geol. Soc. Amer.*, 1943, 54, 401—455).—The hypothesis that the earth represents meteoritic material is discussed. The principal characteristics, e.g., chemical and mineralogical composition, of meteoritic stones and irons are summarised, and reasons for supposing them to be fragments of a disrupted parental planet given. L. S. T.

Cooling of the earth. L. B. Slichter (*Bull. Geol. Soc. Amer.*, 1941, 52, 561—600).—Data and hypotheses relevant to the cooling problem of the earth are reviewed, and the theory of the cooling of a solid radioactive earth is developed by a method which identifies the problem with an equiv. one in the cooling of a non-radioactive earth. It is probable that the mantle solidified from the bottom upwards, beginning at the boundary of the core. Little correlation exists between radioactivity at depth and observed surface heat flux. It is unknown whether the earth is heating or cooling at depth. There is no need for a marked rate of decrease of radioactive substance with depth. The view that the indicated amounts of radioactivity in the earth are unnecessarily large and \gg the amounts to be expected from observed surface heat flows is fallacious. L. S. T.

Some petrological concepts and the interior of the earth. A. F. Buddington (*Amer. Min.*, 1943, 28, 119—140).—An address. L. S. T.

Radioactivity of rocks. R. D. Evans and C. Goodman (*Bull. Geol. Soc. Amer.*, 1941, 52, 459—490).—Several hundred radioactivity measurements are tabulated and, with results of other investigators, are used to obtain the following average vals. for rocks of various types: acidic igneous rocks (43), $1.37 \pm 0.17 \times 10^{-12}$, intermediate igneous rocks (7), $0.51 \pm 0.05 \times 10^{-12}$, basic igneous rocks (54), $0.38 \pm 0.03 \times 10^{-12}$, sedimentary rocks (28), $0.57 \pm 0.08 \times 10^{-12}$, g. Ra per g. of rock; acidic igneous rocks (26), $3.0 \pm 0.3 \times 10^{-6}$ g. U per g., $13 \pm 2.0 \times 10^{-6}$ g. Th per g. (Th/U ratio 5.0); intermediate igneous rocks (6), $1.4 \pm 0.2 \times 10^{-6}$ g. U per g., $4.4 \pm 1.2 \times 10^{-6}$ g. Th per g. (Th/U 2.6); basic igneous rocks (34), $0.96 \pm 0.11 \times 10^{-6}$ g. U per g., $3.9 \pm 0.6 \times 10^{-6}$ g. Th per g. (Th/U 4.0). The vals. show a more marked decrease of radioactivity with increasing basicity, and are \ll those generally accepted; the Th : U ratios are also greater, and are in better agreement with those expected from geochemical considerations. Inaccuracies in earlier investigations are discussed. Estimates, based on the above vals., of the rate of production of heat by radioactive decay show that Holmes' estimates may have to be substantially decreased. L. S. T.

Porosity of geospheres. G. A. Maximovitsch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 215—216).—Porosity data have been collated, and average, min., and max. porosities calc. for the various geospheres. W. R. A.

Large magnesia-rich triphylite crystals in pegmatite. C. A. Chapman (*Amer. Min.*, 1943, 28, 90—98).—Crystals of triphylite occur in a quartz-albite pegmatite at Newport, New Hampshire. The chemical analysis recorded shows a high $FeO : MnO$ and 7.38% MgO . This abnormally high MgO content may account for the relatively low vals. of n and ρ . Curves showing the variation in composition and optical properties of the lithiophyllite-triphylite series are discussed. L. S. T.

Age of pegmatite veins of the Ilmen Reserve in the Urals. E. K. Gerling and M. E. Vladimirova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 179—184).—The age of the granite intrusions and their pegmatites has been obtained from samarskite (I) and eschinite (II) by the He method. (I) from the Blumovskaya mine has He 3.41 mg. per g., U 0.1038 g. per g., and Th 0.0503 g. per g. The corresponding figures for (II) are 0.591, —, 0.0901. The ages are 248×10^6 and 218×10^6 years, respectively. Curves showing the He evolved by heating (I) at different temp. are reproduced. (II) retains He when heated, only 20% of its total amount being liberated by heating to 1200°. L. S. T.

Stability and formation of minerals of abyssal geospheres in the stratosphere. V. P. Baturin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 32—34).—Evidence is reviewed to show that only those abyssal minerals which are most resistant to weathering (e.g., quartz, rutile, zircon, tourmaline, and feldspars) are capable of synthesis in sedimentary formations. L. J. J.

Pyroxenes of basaltic magma. F. Walker (*Amer. J. Sci.*, 1943, 241, 517—520).—The nomenclature of common clinopyroxenes, the relationship between pigeonite and augite (I), the order of crystallisation of pyroxenes, and the exsolution of (I) from orthopyroxene are discussed (cf. A., 1942, I, 251). L. S. T.

Phosphorite deposits on the sea floor off Southern California. R. S. Dietz, K. O. Emery, and F. P. Shepard (*Bull. Geol. Soc. Amer.*, 1942, 53, 815—847).—Nodular phosphorite in abundance has been dredged from the sea-floor off Southern California. The nodules are composed of irregular layers of collophane usually enclosing phosphatic oölites, glauconite, and foraminiferal tests. Chemical analyses (recorded) show a high F content, and X-ray data reveal a typical apatite structure. Origin, probably direct pptn. from ocean H₂O, is discussed. L. S. T.

Geology of phosphate deposits in the United States. G. R. Mansfield (*Bull. Geol. Soc. Amer.*, 1940, 51, 2040—2041). L. S. T.

Presence of cobalt in iron ore from Divrik, Turkey. M. Gysin (*Arch. Sci. phys. nat.*, 1942, [v], 24, Suppl., 142—147).—The Fe ore contains small amounts of Co, localised in the Fe pyrite, and traces of Ni. The ore also contains an unidentified yellowish-grey mineral containing Fe and S, but no Co, Ni, or Cu, and probably no As or Sb. L. S. T.

Magnetite-haematite relations in the banded iron formation of W. Australia. K. R. Miles (*Proc. Austral. Inst. Min. Met.*, 1941, No. 124, 193—201).—Evidence that the existing primary Fe oxide of the banded Fe formations of the Older Pre-Cambrian series is magnetite (I) is presented. The Fe was deposited originally probably as the hydroxide or carbonate which, under moderate temp. and pressure, was converted into (I). The later alteration of (I) to haematite is widespread, but is confined commonly to the zone of oxidation in W. Australia, where it has been a supergene process. L. S. T.

Relation between ferro-nickel and nickel ores of the Urals. B. P. Krotov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 141—143). L. S. T.

New silicate structures. N. V. Below (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 139—140).—Structures of diopside, ramsdellite, and "Egyptian blue," CaCu(Si₄O₁₀), are discussed. L. S. T.

Uraninite in Minas [Geraes]. W. Florencio and C. de Castro (*Anais Acad. Brasil. Cienc.*, 1943, 15, 19—29).—Uraninite from Engenho Central contains 240.10 mg. of Ra per metric ton and 77.91% U. F. R. G.

Origin of sulphides in the nickel deposits of Mount Prospect, Connecticut. E. N. Cameron (*Bull. Geol. Soc. Amer.*, 1943, 54, 651—686; cf. A., 1943, I, 211).—The Ni deposits occur within masses of olivine norite, quartz norite, and hypersthene pyroxenite intruded in the order given; they are regarded as high-temp. hydrothermal. L. S. T.

Gold-nickel mineralisation at Alistos, Sinaloa, Mexico. P. Krieger and A. F. Hagner (*Amer. Min.*, 1943, 28, 257—271).—An occurrence of Au-Ni ore from Alistos, Mexico, is described. It consists of (i) Au-niccolite, containing minor amounts of gersdorffite (I) and maucherite, and (ii) Au-millerite with associated (I), pentlandite, and violarite. The mineral assemblage, particularly the association of native Au with niccolite and primary millerite, is unusual. The ore minerals may have originated from a peridotite stock by hydrothermal alteration; end-stage solutions from the peridotite magma removed Ni and probably Au from the peridotite and deposited them in latite as veins of Ni arsenides and sulphides, and native Au. L. S. T.

Abrigo [Arizona] limestone. J. H. Wiese (*Bull. Geol. Soc. Amer.*, 1940, 51, 1964).—The limestone was deposited in the neritic zone of a warm sea, the calcite being derived mainly from calcareous

shell fragments and, in part, by pptn. Most of the formation consists of thin alternating layers of limestone and shale. Differential dissolution under pressure explains many of the irregularities in thickness of the alternating layers. Dolomitisation is widespread. L. S. T.

Crystallisation of salt as a factor in rock weathering. E. Blackwelder (*Bull. Geol. Soc. Amer.*, 1940, 51, 1956).—Crystallisation of salt disrupts rocks along joints, cleavage, and other lines of weakness. L. S. T.

Origin of caliche. W. A. Price (*Bull. Geol. Soc. Amer.*, 1940, 51, 1939).—Caliche is the end-product in well-drained, well-developed soils of the process of "soil-lime" accumulation. Conc. occurs well above H₂O table in lower soil zones and in weathered or porous parent materials through normal soil processes of dry climates where rates of weathering, soil development, and soil erosion are balanced. L. S. T.

Industrial limestones in Virginia. A. Bevan (*Bull. Geol. Soc. Amer.*, 1940, 51, 2039). L. S. T.

Geology of the Coeur d'Alene mining district, Idaho. K. Whiting (*Bull. Geol. Soc. Amer.*, 1940, 51, 2036—2037). L. S. T.

Geology of the Shasta copper belt. G. F. Seager (*Bull. Geol. Soc. Amer.*, 1940, 51, 2031—2032). L. S. T.

Solution effects on limestone as a function of slope. J. F. Smith, jun., and C. C. Albritton, jun. (*Bull. Geol. Soc. Amer.*, 1941, 52, 61—78).—Corrosive effects in the Sierra Blanca area are primarily a function of the degree of slope on which the meteoric H₂O falls. L. S. T.

Late Tertiary geology southeast of Mono Lake, California. C. M. Gilbert (*Bull. Geol. Soc. Amer.*, 1941, 52, 781—815).—Chemical analyses [E. S. Shepherd] are recorded. L. S. T.

Geology of the Stony Mountain stock, San Juan Mountains, Colorado. M. Dings (*Bull. Geol. Soc. Amer.*, 1941, 52, 695—720).—Chemical analyses of the Governor diorite and of a gabbro are recorded. L. S. T.

Chemical and physical properties of the clay minerals nontronite, attapulgite, and saponite. O. G. Caldwell and C. E. Marshall (*Univ. Missouri Agric. Exp. Stat.*, Oct., 1942, *Bull.* 354, 51 pp.).—Nontronite (I) (Carolina), attapulgite (II) (Georgia), and saponite (III) (California) were examined for dispersion and mechanical analysis (down to 50 mμ.) and chemical composition. Electrodialysis caused slight decomp. of (I) and (II), whereas (III) decomposed completely, with Si and Mg moving to the cathode. The base exchange of the various fractions of the clays (using NH₄⁺ at pH 7 and Ca⁺⁺ at pH 5, 7, and 9) varied little with the particle size or treatment. (I), (II), and (III) gave 65, 21, and 80 m-equiv. per 100 g. of calcined clay, respectively. Titration curves are given. (I) has the beidellite, (II) the amphibole, and (III) the montmorillonite type of structure. The dehydration behaviour of the various fractions was studied. Flakes or films gave much higher H₂O contents than did ground clays, probably due to H₂O trapped in the structure. Bradley's structure for (II) is modified slightly by providing for 10 (OH) per cell instead of 4 H₂O and 2 (OH). Determinations of *d* of the fractions were made in HgCl₂ solutions. The effects of drying and heat-treatment up to 870° on the *n* of the various clay fractions were determined. On heating to 110°, *n* of (I) and (III) increased and rehydration restored the original val., but *n* of (II) decreased and was not restored by rehydration. The Wisner theory of the birefringence of regular aggregates is discussed in connexion with superimposed lattice and film structures, the latter type being well illustrated by (II), which has a non-expanding lattice structure. It is likely that clay minerals could be identified and estimated in mixtures by means of *n* determined under three or four different conditions. Grinding a clay film, by destroying the film structure, decreases the H₂O content, but very fine grinding causes it to increase again. More study is needed before it is possible to define the degree of grinding necessary to attain the min. H₂O content of a clay sample. J. A. S.

Decomposition of kaolin by diatoms. A. P. Vinogradov and E. A. Boitschenko (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 135—138).—Bacteria-free diatoms (*Nitzschia palea* and *Navicula minuscula*) decompose nacrite (I) liberating Al₂O₃.nH₂O, probably by the action of their pectinous slime. *Azotobacter chroococcum* without diatoms does not decompose (I). L. S. T.

Eocene anauxite clays and sands in the coast range of California. V. T. Allen (*Bull. Geol. Soc. Amer.*, 1941, 52, 271—293).—Mineral and chemical analyses are recorded. L. S. T.

Clays and soils in relation to geologic processes. C. S. Ross (*J. Washington Acad. Sci.*, 1943, 33, 225—235).—A review, illustrated by sp. studies, of certain geological problems on which clay and soil materials have a bearing. L. S. T.

Organic matter of ball clays.—See B., 1943, III, 229.